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(12) **United States Patent**
Moss et al.

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(54) **QUICK CHANGE BIT HOLDER WITH RING MAGNET**

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(73) Assignee: **BLACK & DECKER INC.**, New Britain, CT (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 259 days.

(21) Appl. No.: **13/967,775**

(22) Filed: **Aug. 15, 2013**

(65) **Prior Publication Data**

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Related U.S. Application Data

(63) Continuation-in-part of application No. 13/766,135, filed on Feb. 13, 2013.

(60) Provisional application No. 61/599,222, filed on Feb. 15, 2012.

(51) **Int. Cl.**
B25B 23/00 (2006.01)
B25B 23/12 (2006.01)

(52) **U.S. Cl.**
CPC **B25B 23/0035** (2013.01); **B25B 23/12** (2013.01); **Y10T 279/17** (2015.01); **Y10T 279/17957** (2015.01)

(58) **Field of Classification Search**

CPC B25B 23/0035; B25B 23/02; B25B 23/12
See application file for complete search history.

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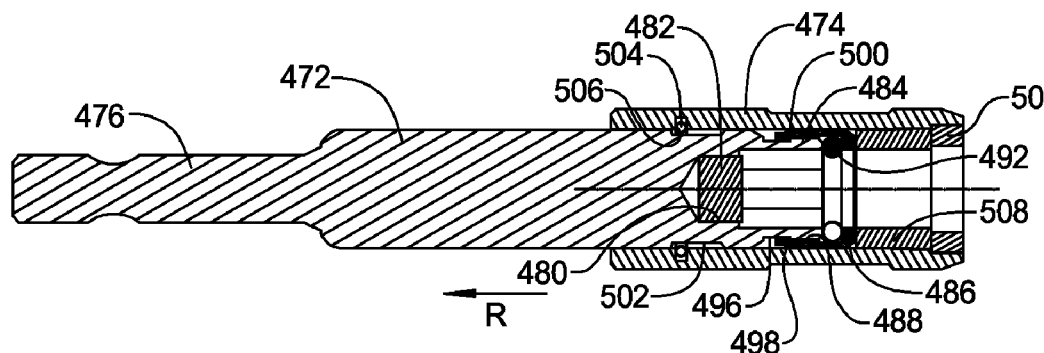
Primary Examiner — David B Thomas

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(57) **ABSTRACT**

A bit holder assembly for a rotary hand or powered tool, includes a body having a hex shank at its rearward end and a retraction collar slidably disposed on the body. The body has a coaxial hex socket formed therein to allow a tool bit to be inserted therein. A coil spring biases the retraction collar forwardly and biases a retaining clip toward the bottom of an angular slot formed in the body. The bit is removed by sliding the retraction collar rearwardly, to compress the coil spring and allow the retaining clip to retract back up the slot. A ring magnet is disposed at the forward end of the retraction collar to magnetize a fastener to retain the fastener to the bit.

16 Claims, 25 Drawing Sheets



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Three (3) photographs of a Vessel 2H drill bit with floating magnet sleeve.

Photographs of a bit holder with a floating ring magnet (2 pages).
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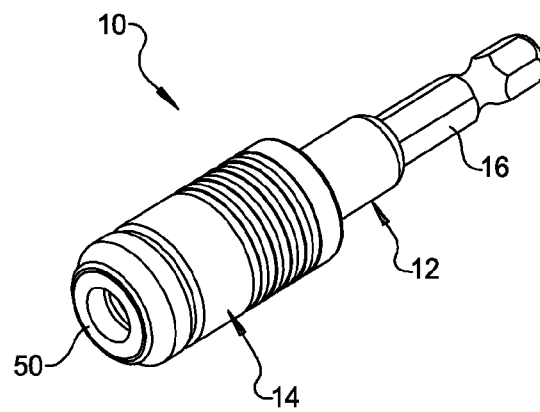


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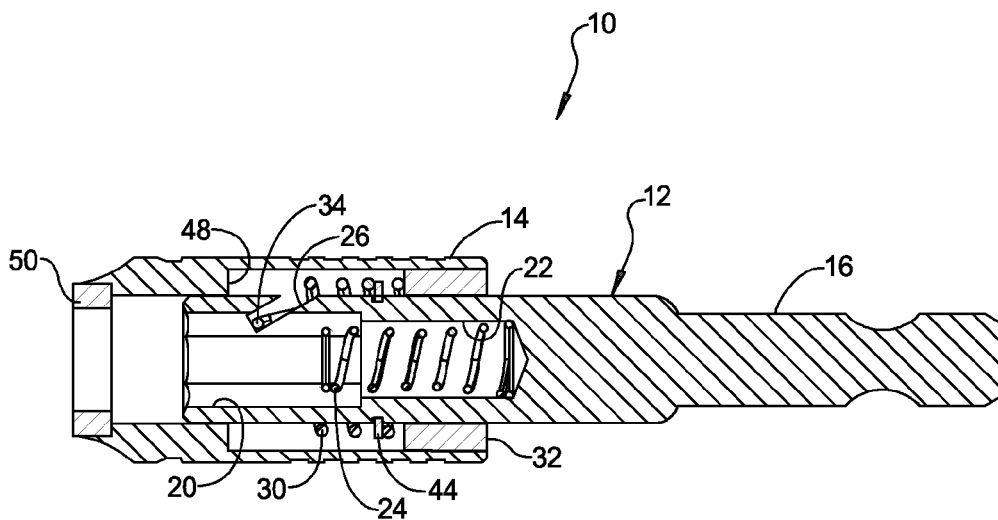


FIG 2

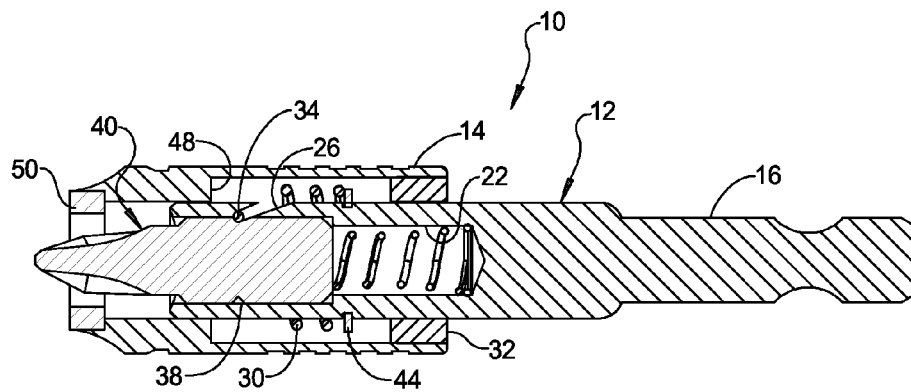


FIG 3

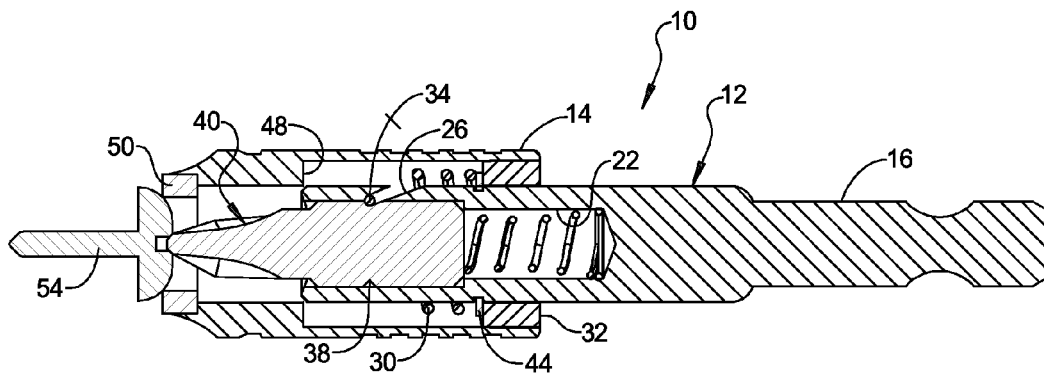


FIG 4

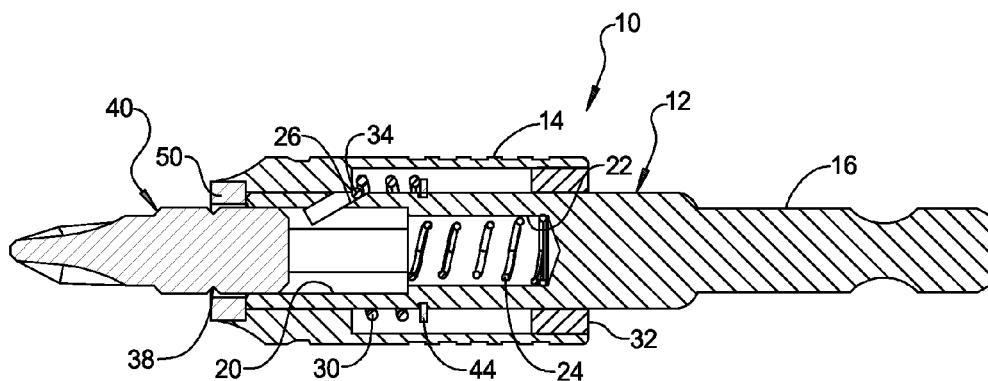


FIG 5

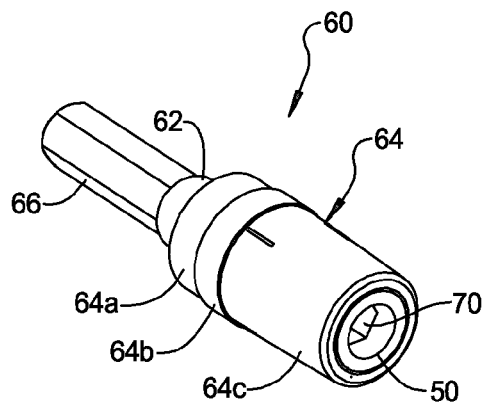


FIG 6

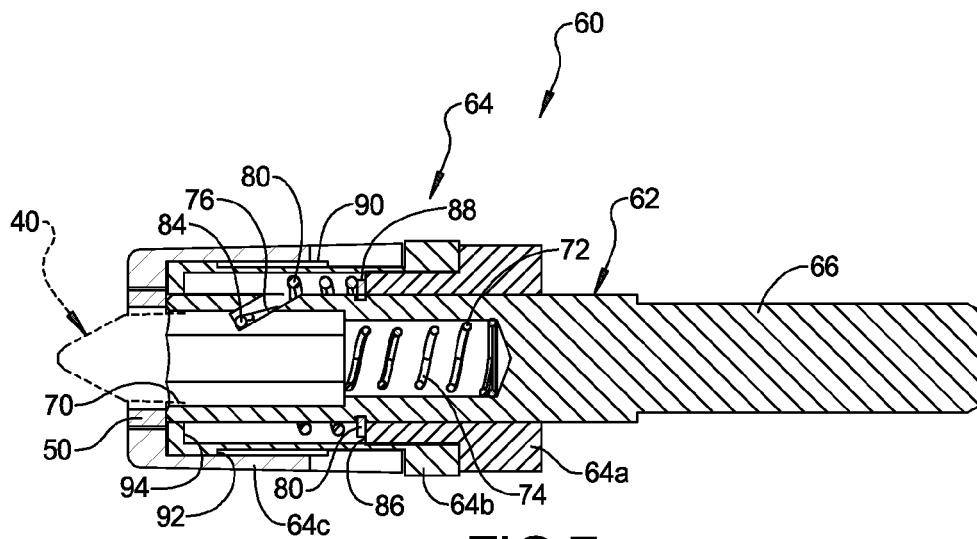


FIG 7

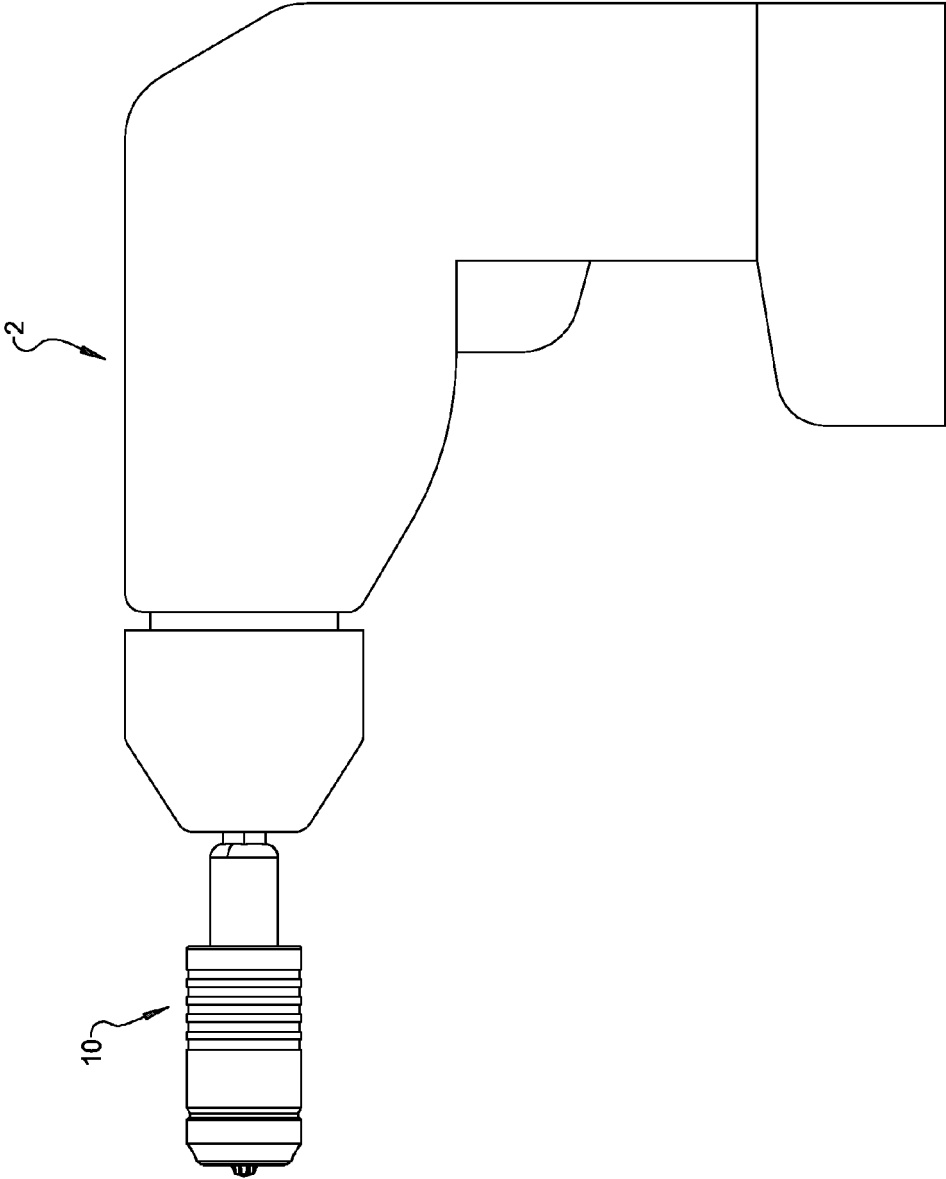


FIG 8

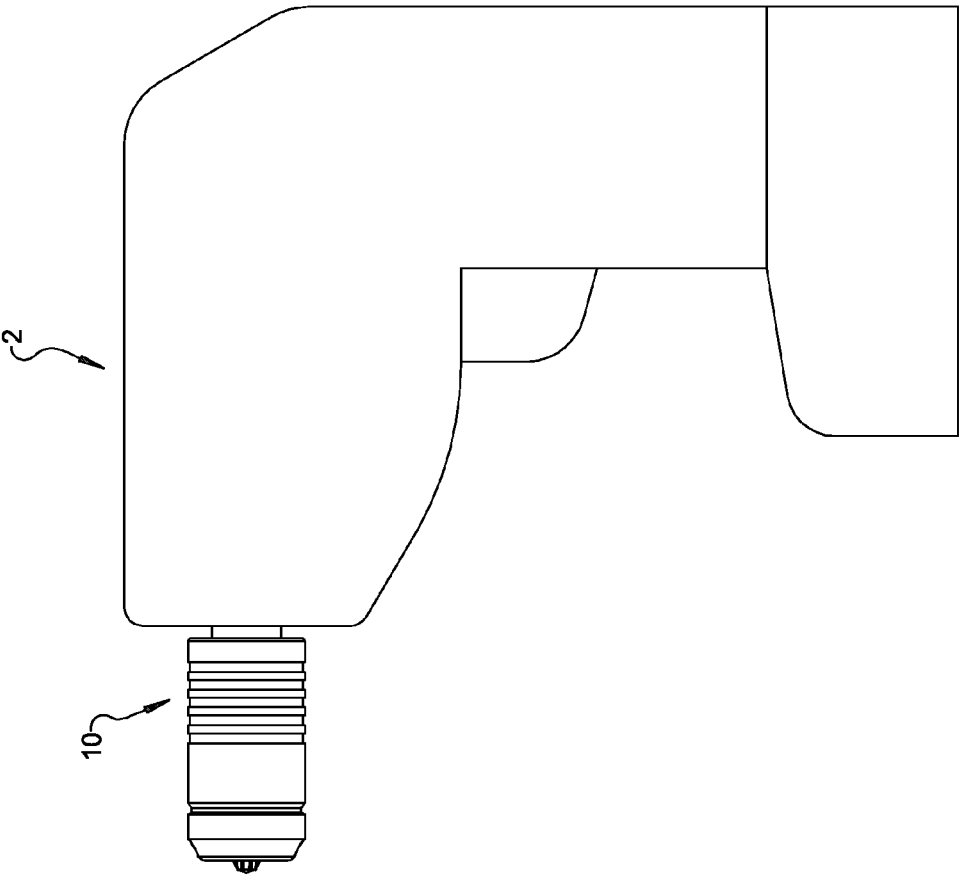


FIG 9

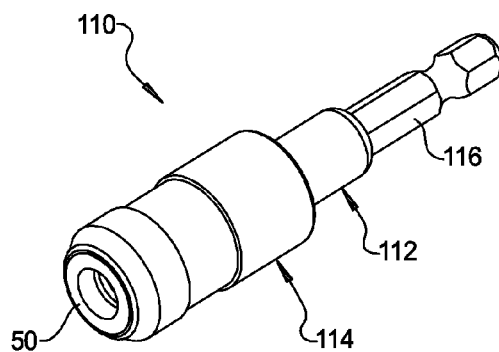


FIG 10

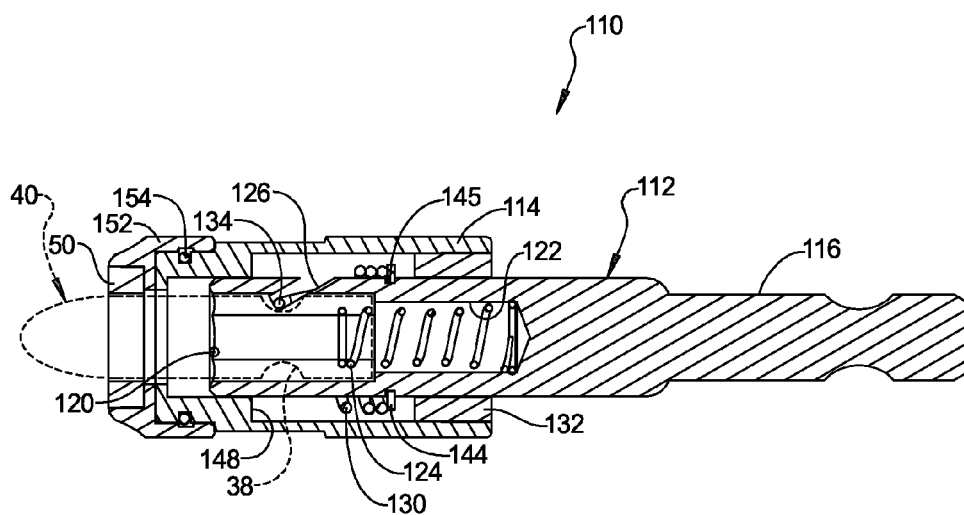


FIG 11

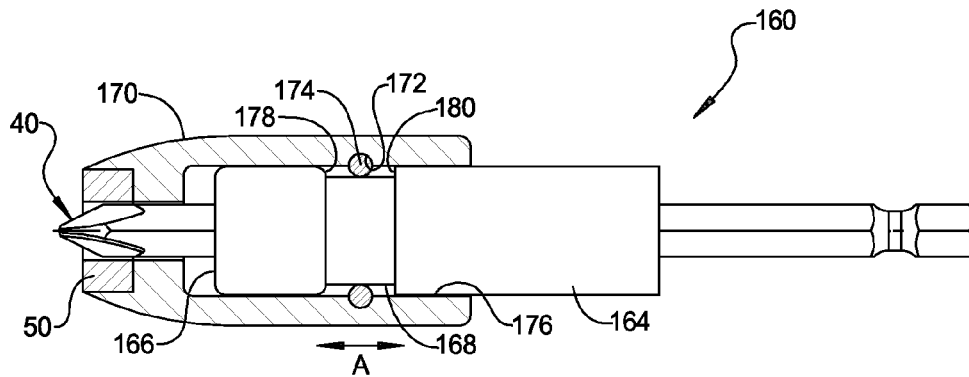


FIG 12

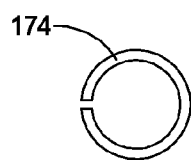


FIG 13

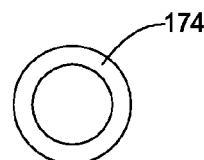


FIG 14

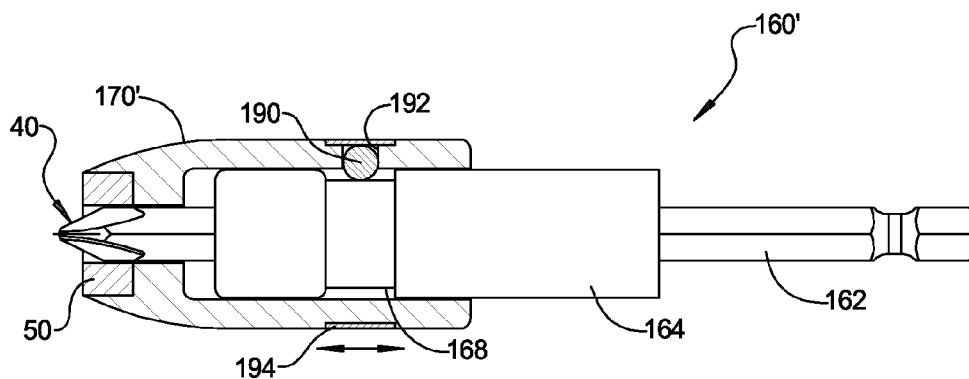


FIG 15

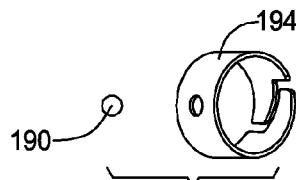


FIG 16

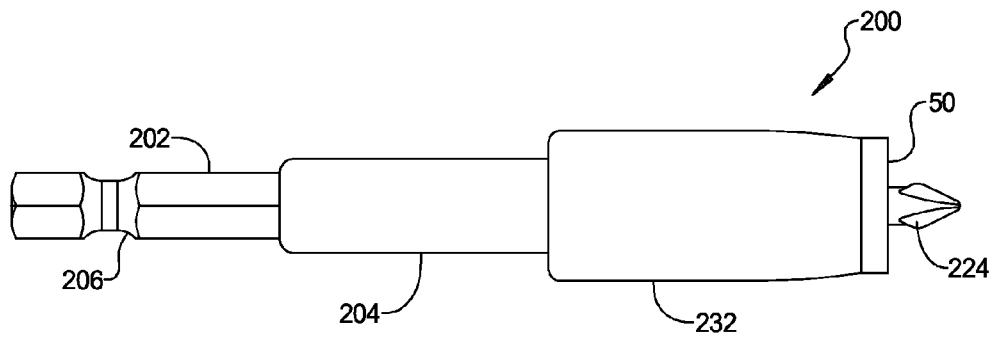


FIG 17

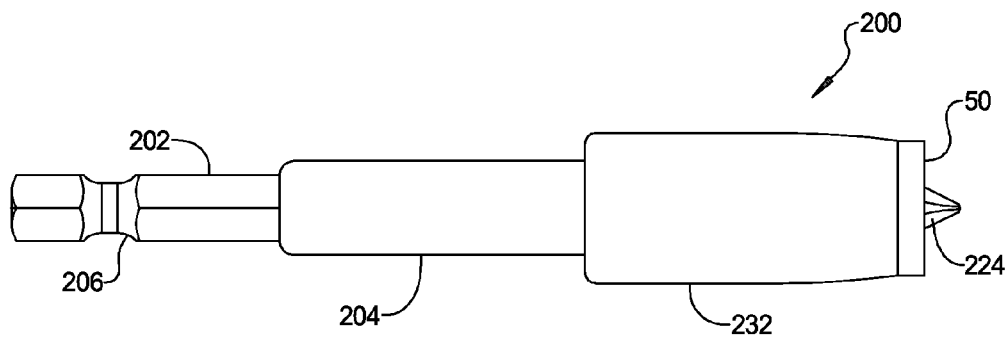


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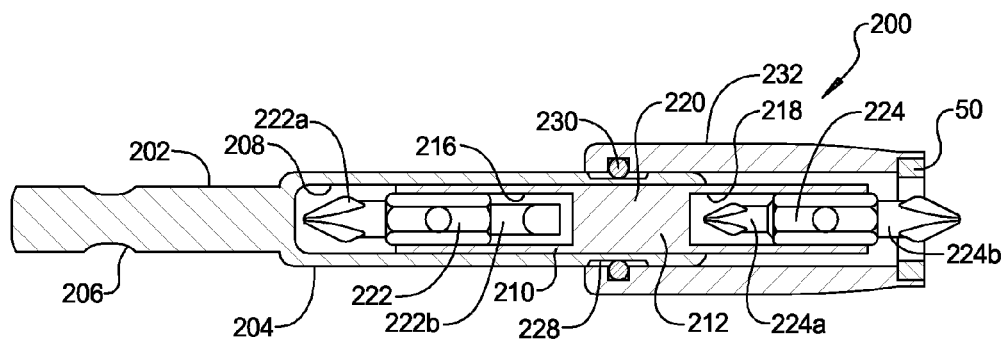


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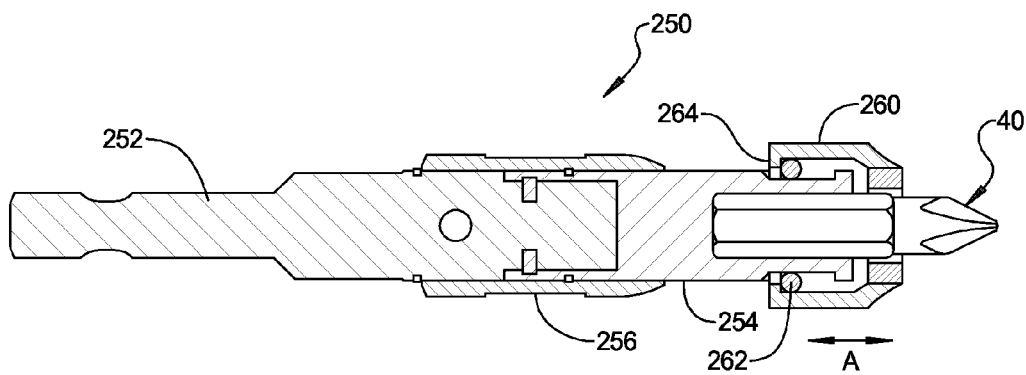


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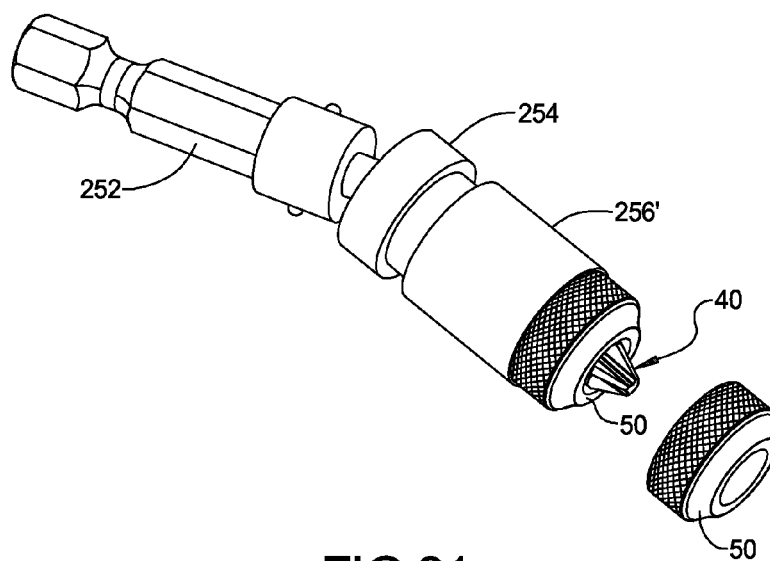


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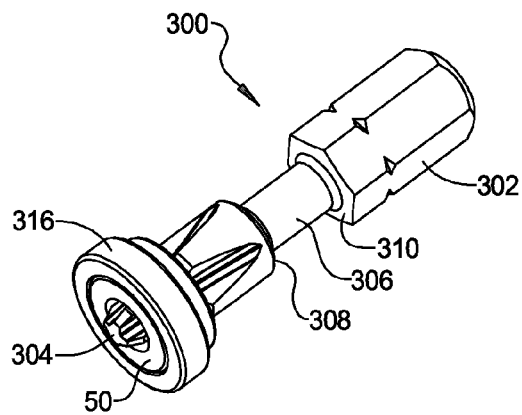


FIG 22

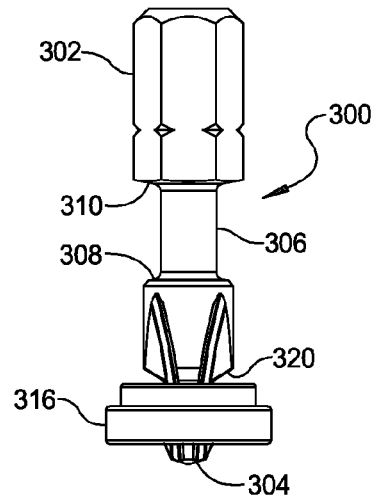


FIG 23

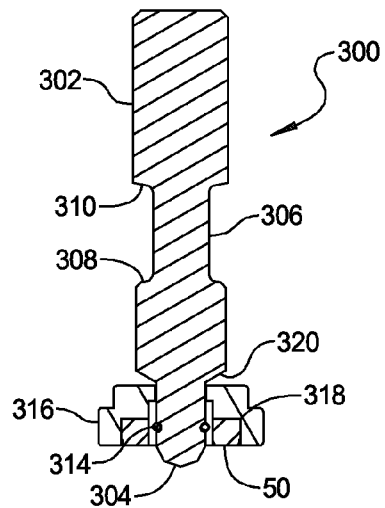


FIG 24

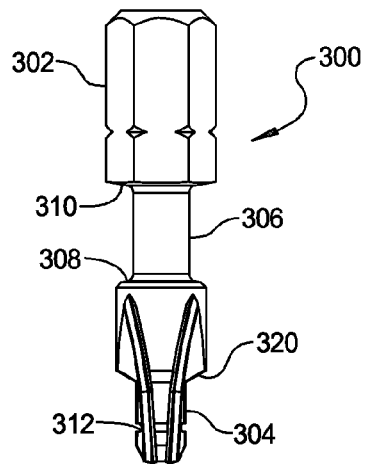


FIG 25

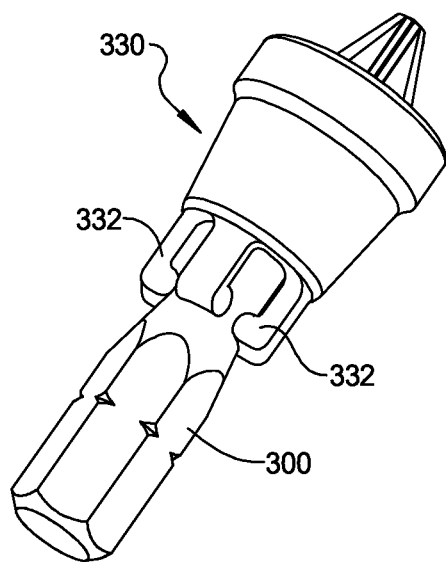


FIG 26

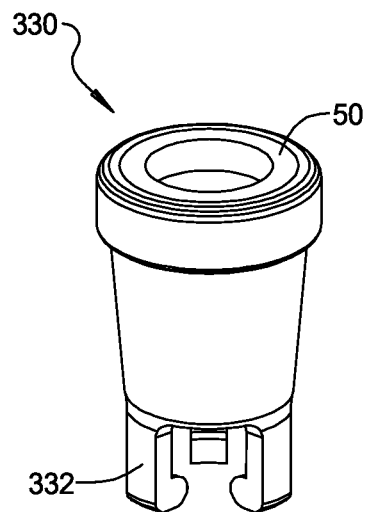


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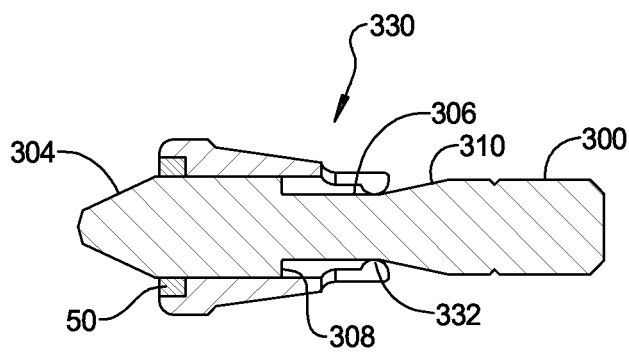


FIG 28

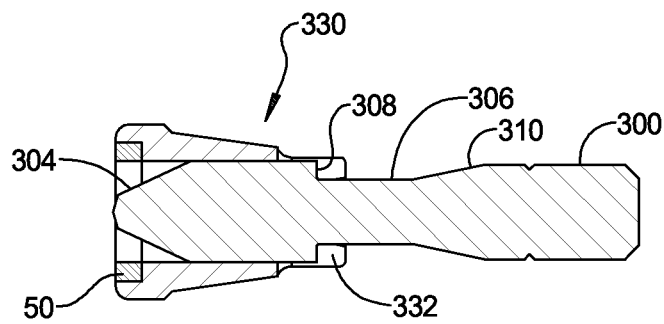


FIG 29

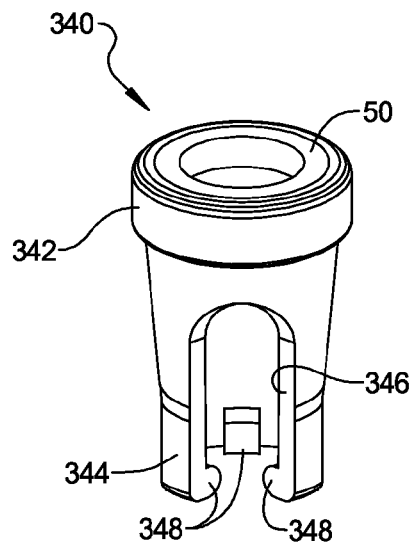


FIG 30

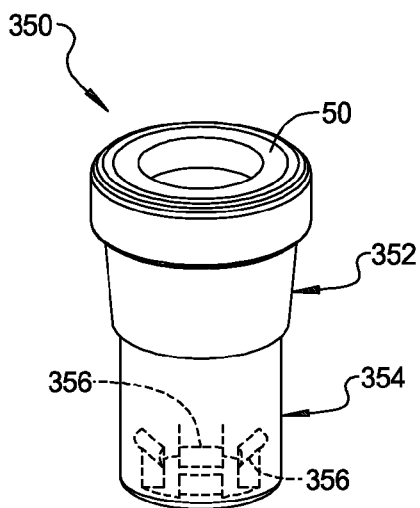


FIG 31

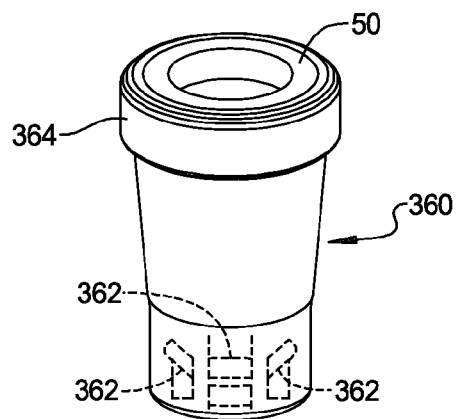


FIG 32

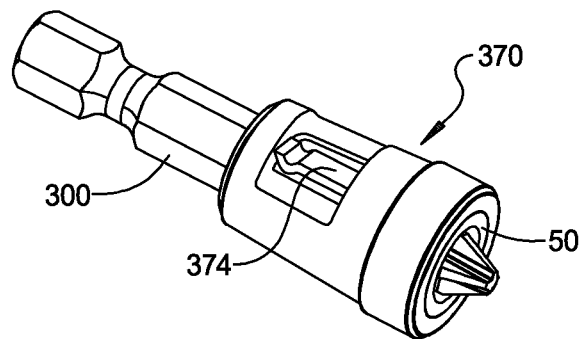


FIG 33

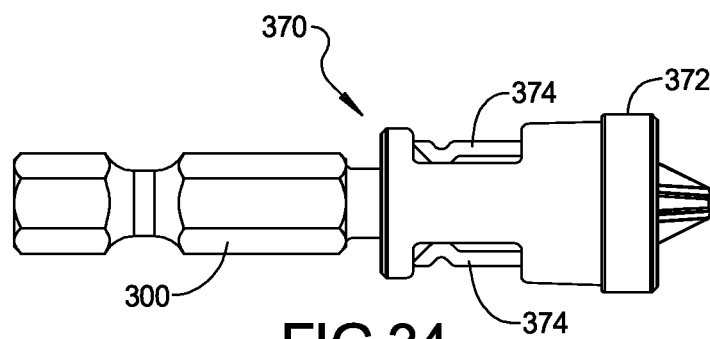


FIG 34

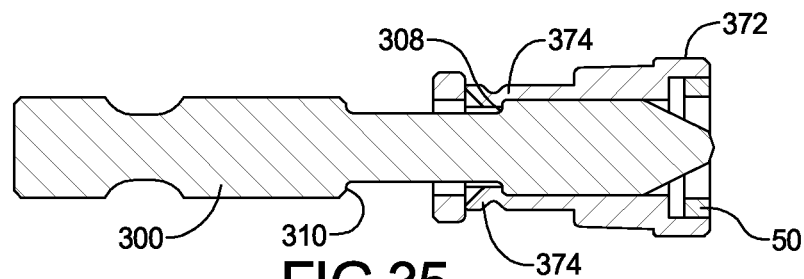


FIG 35

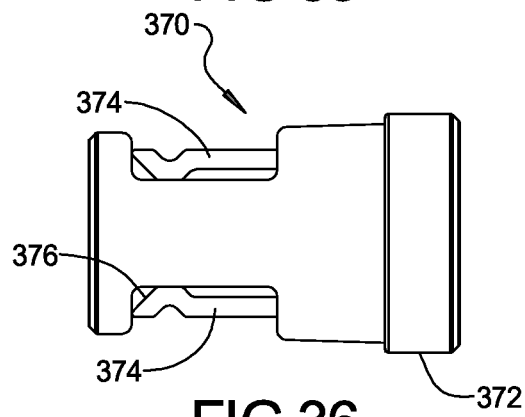


FIG 36

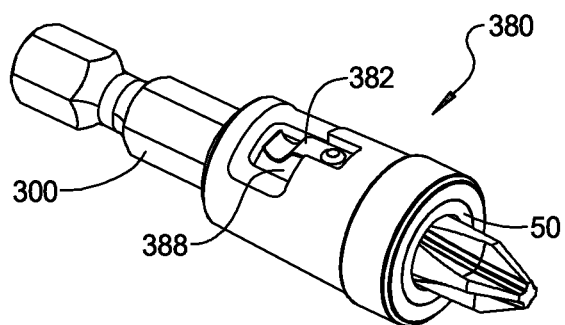


FIG 37

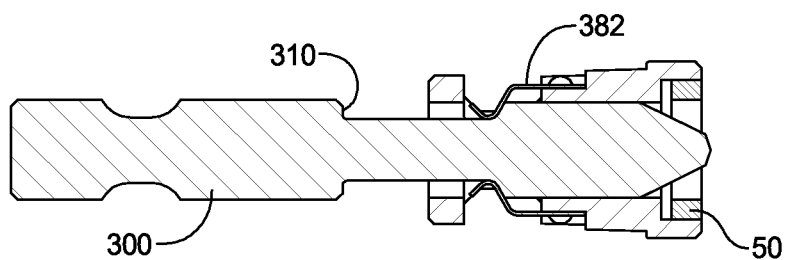


FIG 38

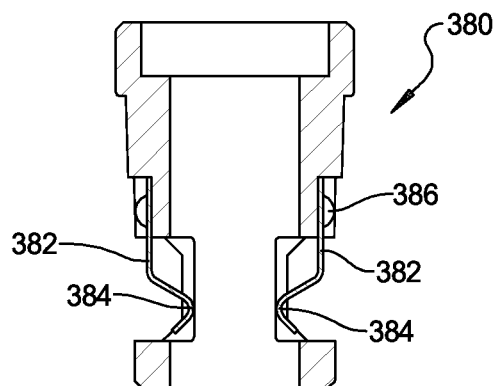


FIG 39

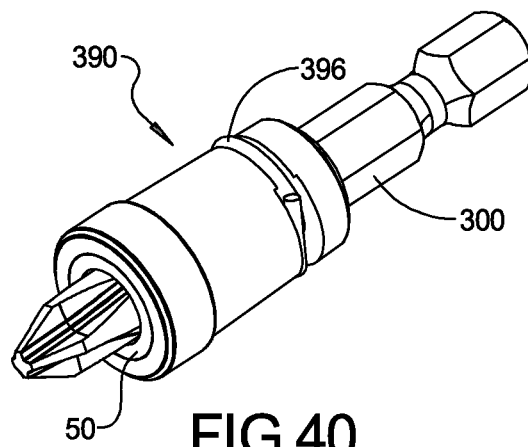


FIG 40

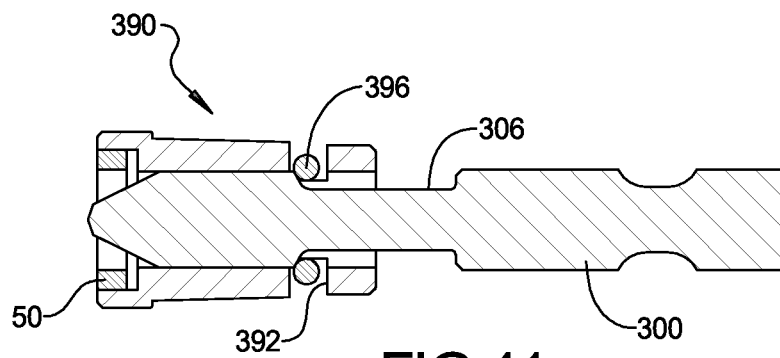


FIG 41

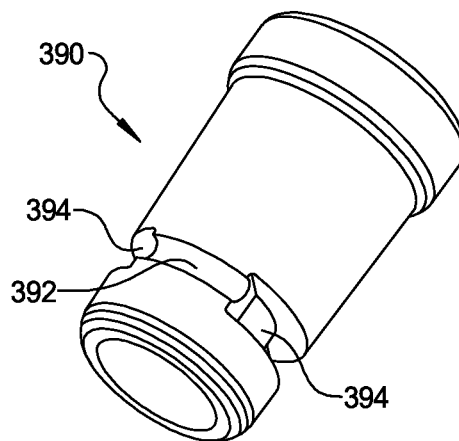


FIG 42

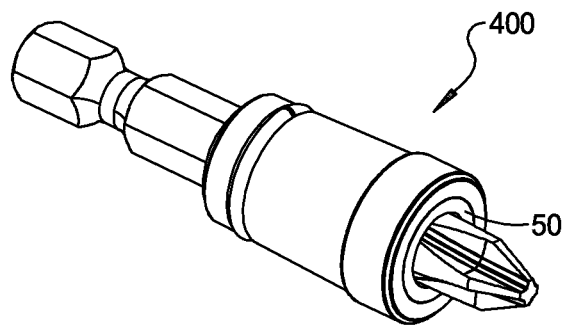


FIG 43

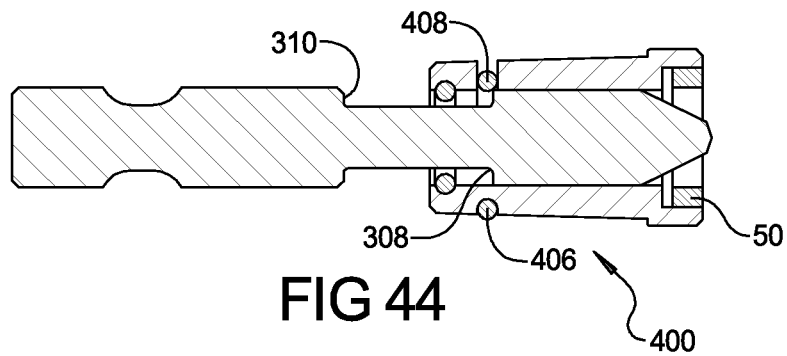


FIG 44

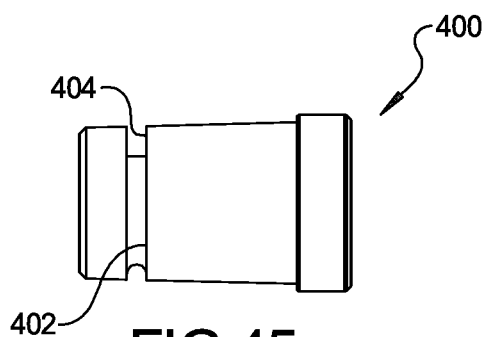


FIG 45

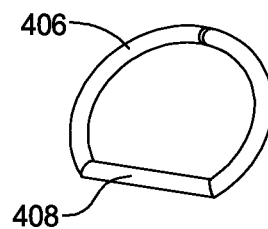


FIG 46

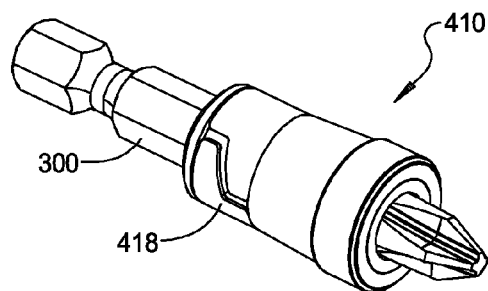


FIG 47

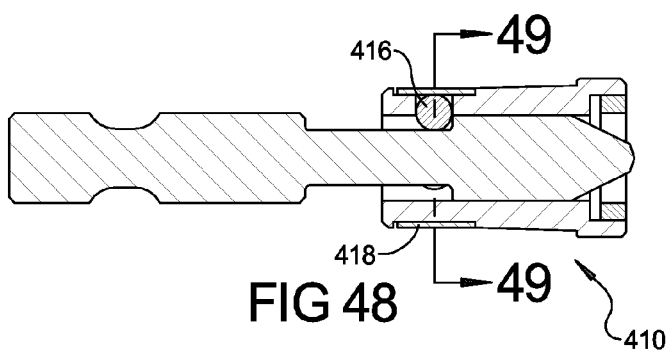


FIG 48

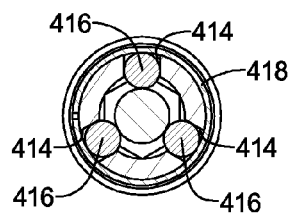


FIG 49

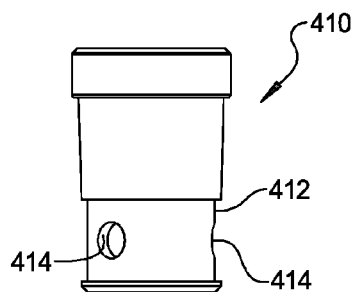


FIG 50

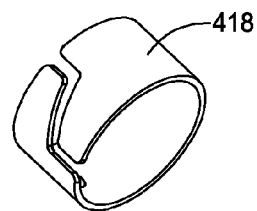


FIG 51

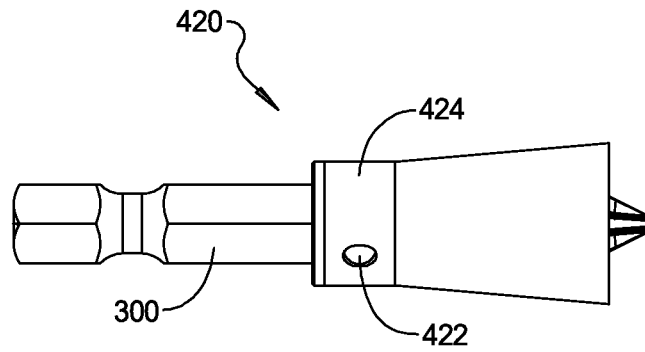


FIG 52

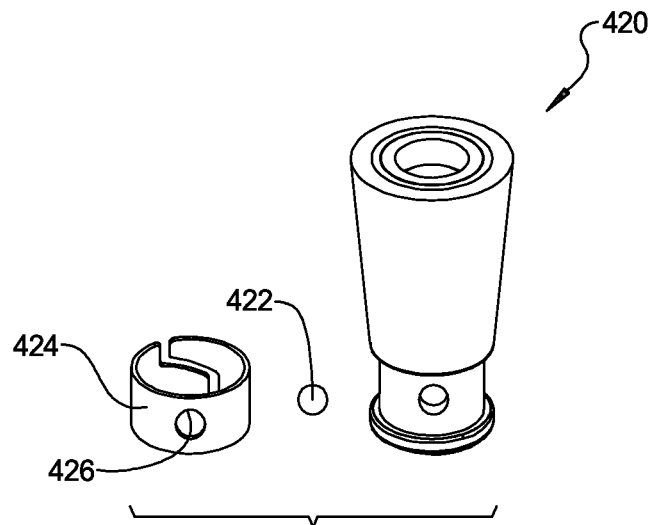


FIG 53

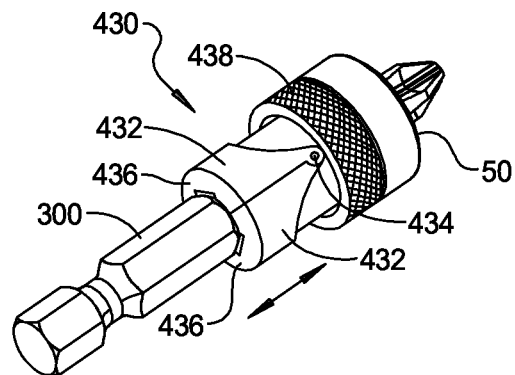


FIG 54

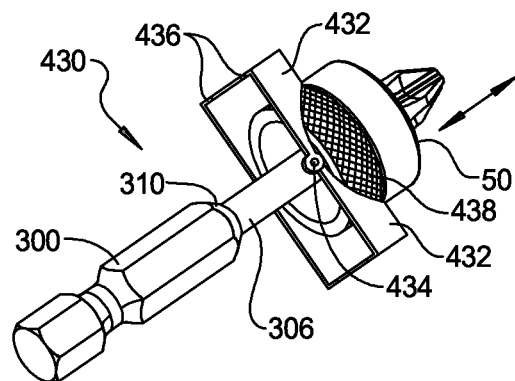


FIG 55

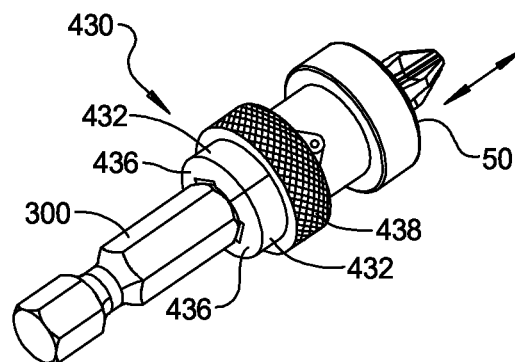


FIG 56

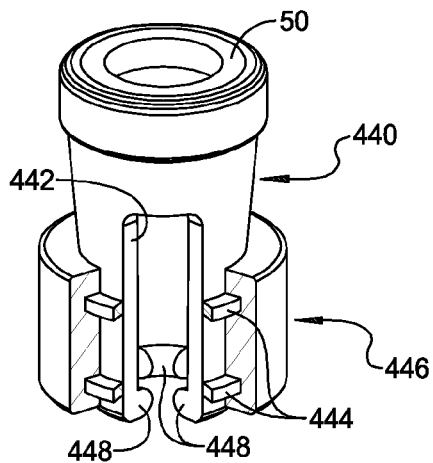


FIG 57

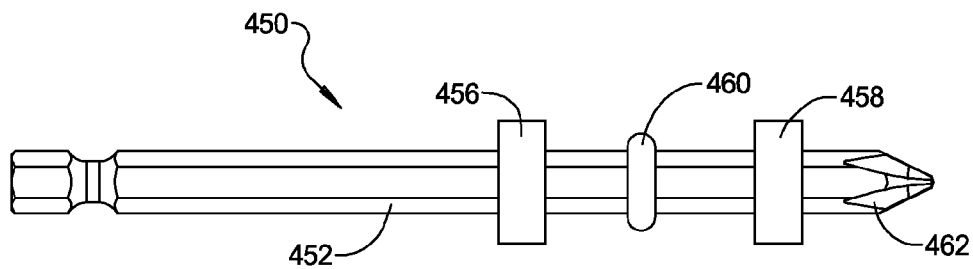


FIG 58

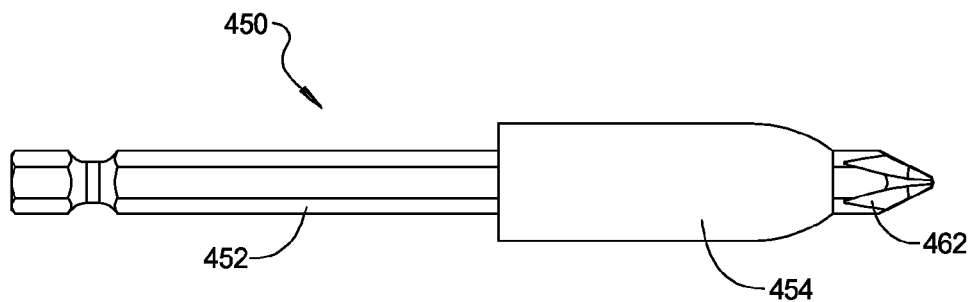


FIG 59

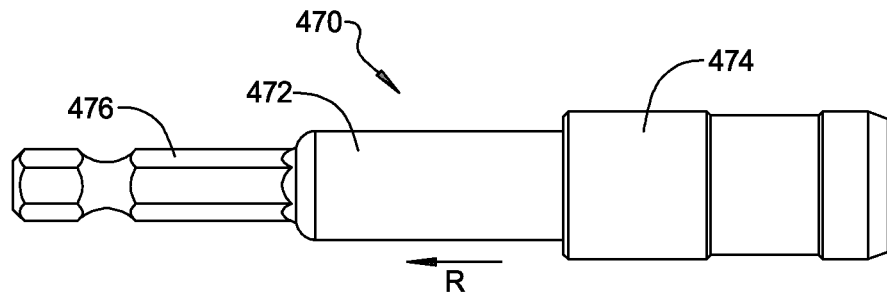


FIG 60

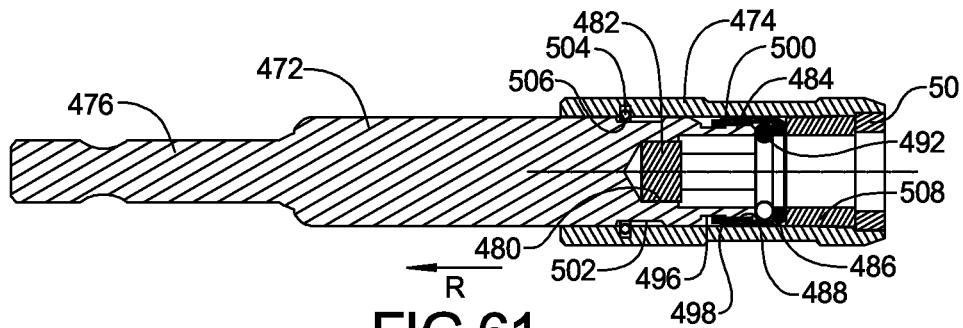


FIG 61

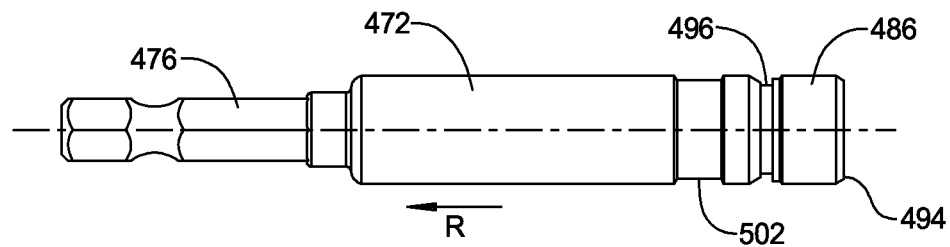


FIG 62

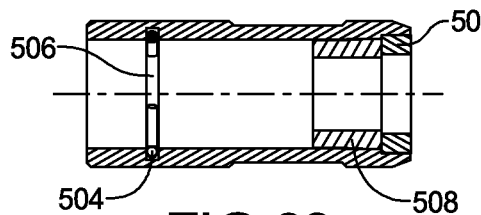


FIG 63

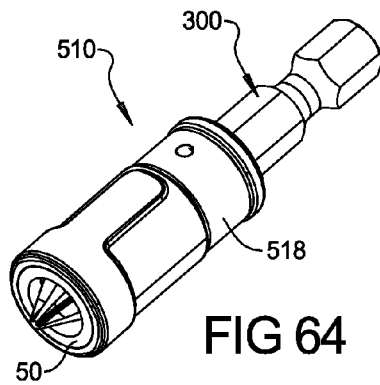


FIG 64

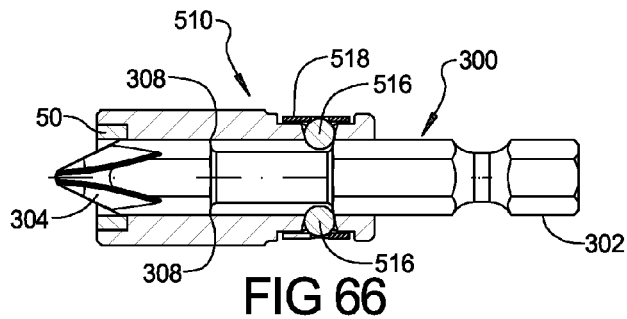


FIG 66

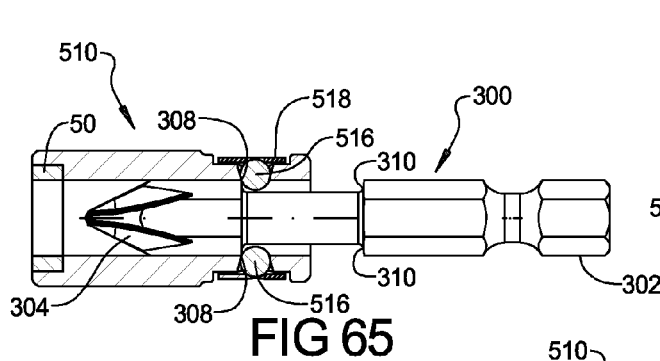


FIG 65

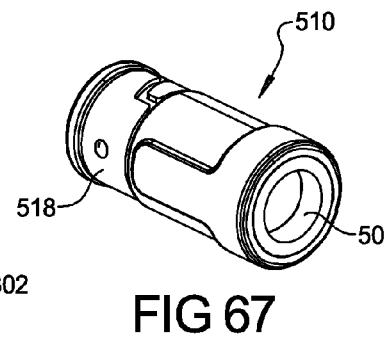


FIG 67

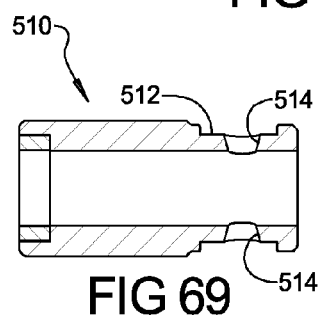


FIG 69

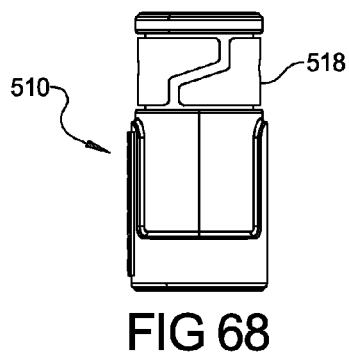


FIG 68

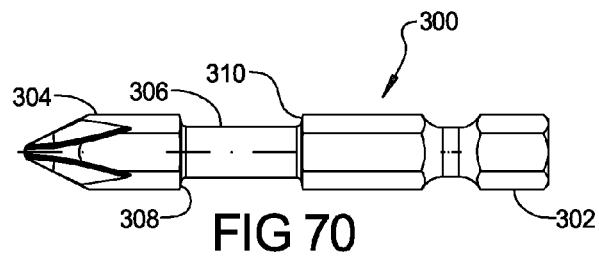


FIG 70

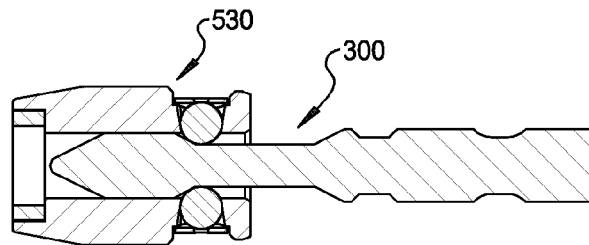


FIG 71A

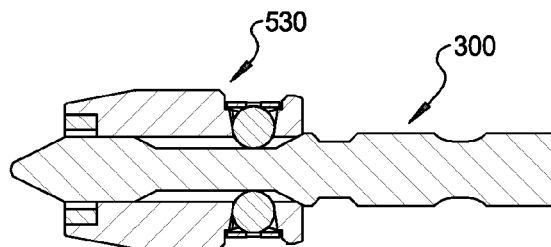


FIG 71B

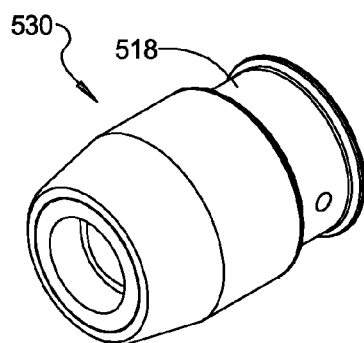


FIG 72

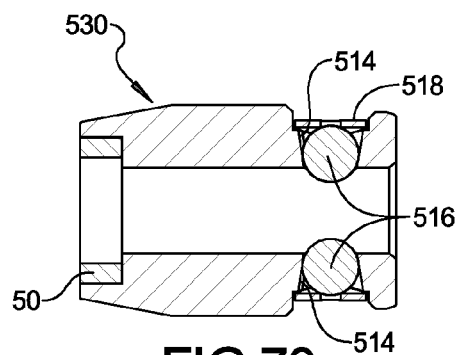


FIG 73

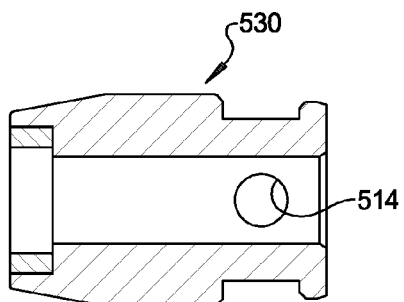


FIG 74

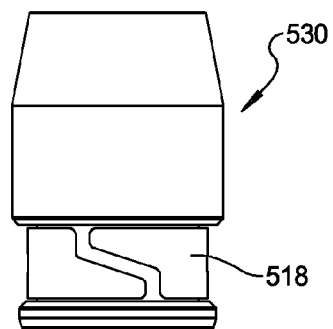


FIG 75

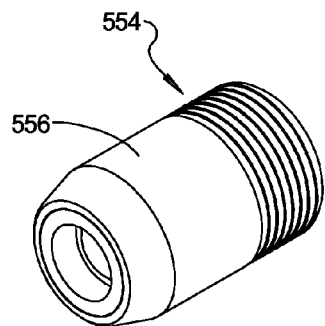


FIG 78

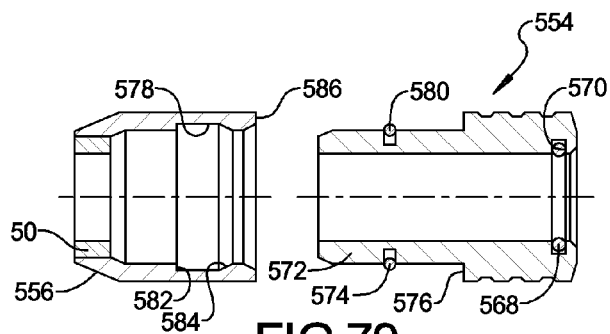


FIG 79

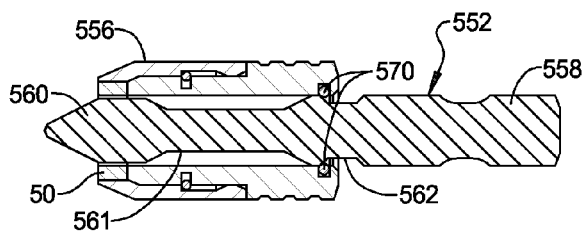


FIG 76

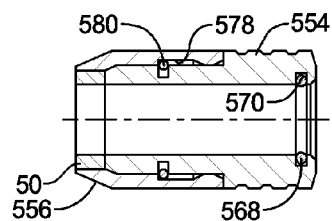


FIG 80

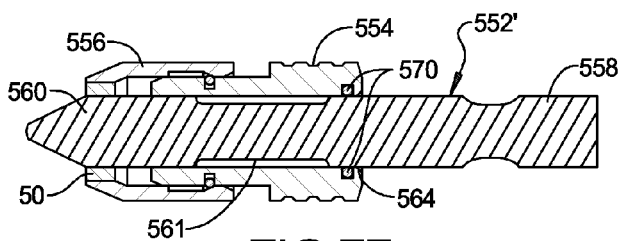


FIG 77

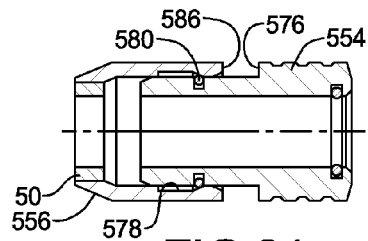


FIG 81

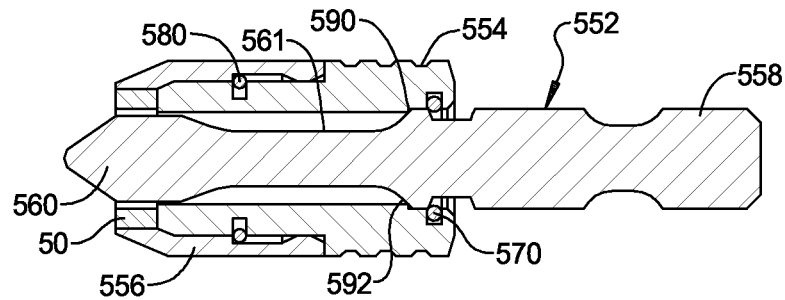


FIG 82

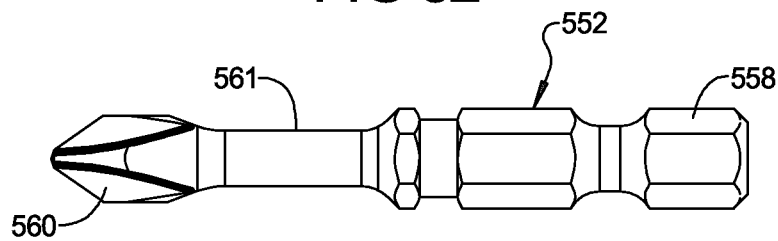


FIG 83

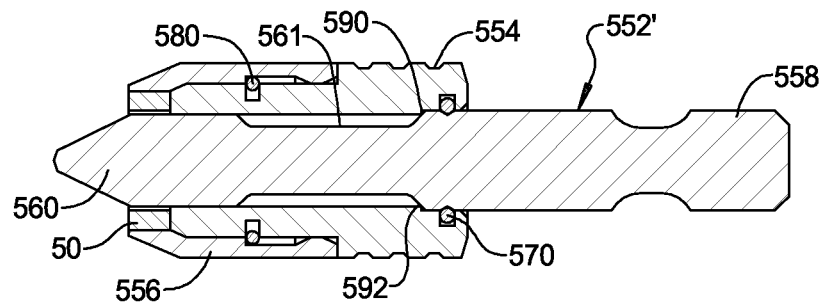


FIG 84

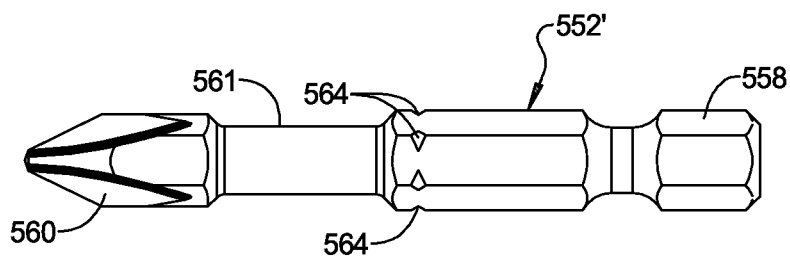


FIG 85

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**QUICK CHANGE BIT HOLDER WITH RING
MAGNET****CROSS-REFERENCE TO RELATED
APPLICATIONS**

This application is a continuation-in-part of U.S. application Ser. No. 13/766,135, filed Feb. 13, 2013, which claims the benefit of U.S. Provisional Application No. 61/599,222, filed Feb. 15, 2012. The entire disclosures of the above applications are incorporated herein by reference.

FIELD

The present disclosure relates to power tool and hand tool bits and bit holders and more particularly, to a bit and a quick change bit holder with a floating ring magnet for retaining a fastener to the bit.

BACKGROUND

This section provides background information related to the present disclosure which is not necessarily prior art.

Auxiliary chucks for power and hand tools have become increasingly common, especially as the need and desirability of wider versatility in the use of power tools and hand tools has increased. Such auxiliary chucks allow the hand or power tool to be used with any of a number of interchangeable bits. This, in turn, has resulted in demands for greater speed, convenience and ease of insertion and removal of tool bits from such chucks.

In one exemplary type of such conventional quick-release chucks, one or more detent balls are positioned within a hollow, barrel-shaped tool bit holder body and are resiliently biased into engagement with a circumferentially-extending groove or recess on the shank of the tool bit. An example of such a ball-type mechanism is disclosed in commonly assigned U.S. Pat. No. 5,988,957 which is herein incorporated by reference. In other conventional quick release chucks, a spring biased clip is used to engage the bit within the tool bit holder body. Examples of the spring biased clip design are disclosed in commonly assigned U.S. Pat. Nos. 7,086,813 and 6,929,266 which are herein incorporated by reference.

SUMMARY

This section provides a general summary of the disclosure, and is not a comprehensive disclosure of its full scope or all of its features.

Although the above types of bit holders have been found to function acceptably, the present disclosure provides a simple, relatively inexpensive quick-acting chuck assembly or bit holder that includes a ring magnet at a forward end of the retraction collar to magnetize a fastener and assist in both retaining the fastener to the bit and stabilizing the fastener during its installation. The ring magnet can be supported to allow the magnet to float in a forward direction to engage the fastener or a rearward direction to release the bit for a rapid one handed bit change. The length of the float and the geometry of the magnet are such as to allow for the feature to work with fasteners of different head configurations and with all bit lengths within the normally accepted industry tolerances.

The present disclosure provides a body having a coaxially extending hex-shaped bore therein for receiving a hex-shaped bit. A spring biased retraction collar is mounted to the body and engages means for releasably retaining the hex-shaped

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tool within the bore. The retraction collar supports a magnet at a forward end thereof and allows the magnet to float in a forward direction to engage and magnetize a fastener engaging the bit. The magnet can be in the form of a ring magnet and can be fixedly mounted to the retraction collar, wherein the magnet causes the retraction collar to move in the forward direction. Alternatively, the retraction collar can include a floating sleeve that supports the magnet and allows the magnet to float forward relative to a remainder of the retraction collar.

According to further aspects of the present disclosure, a bit holder is provided with a floating ring magnet supported on the bit holder. The bit holder can be a pivoting bit holder or a multi-tool bit holder such as a six-in-one rotary tool.

According to a still further aspect of the present disclosure, a tool bit is provided with a floating sleeve that supports a ring magnet at a forward end of the tool bit. The floating sleeve can be supported on the tool bit by various techniques as will be disclosed herein. The tool bit can be a torsion bit that includes a shank portion and a working region with a reduced diameter torsion zone disposed therebetween. The reduced diameter torsion zone has a shoulder on a forward and rearward end of the torsion zone to aid in retaining the floating sleeve on the tool bit.

According to another aspect, a magnet assembly is provided for retaining a fastener on a tool bit, the magnet assembly including a floating sleeve and a first ring magnet disposed at a front end portion of the floating sleeve. A second ring magnet is disposed at a rear end portion of the floating sleeve, wherein the first and second ring magnets are arranged with their poles opposing one another such that the floating sleeve is moveable freely along a length of the tool bit, and the first ring magnet is configured to engage a head of a fastener. The first and second ring magnets are disposed approximately 10 mm apart from each other and can include an O-ring disposed inside of the sleeve between the first and second ring magnets to resist movement of the floating sleeve along the tool bit.

Further areas of applicability will become apparent from the description provided herein. The description and specific examples in this summary are intended for purposes of illustration only and are not intended to limit the scope of the present disclosure.

DRAWINGS

The drawings described herein are for illustrative purposes only of selected embodiments and not all possible implementations, and are not intended to limit the scope of the present disclosure.

FIG. 1 is a perspective view of a bit holder assembly according to the principles of the present disclosure;

FIG. 2 is a longitudinal or axial cross-sectional view of the bit holder assembly of FIG. 1;

FIG. 3 is a longitudinal cross-sectional view similar to that of FIG. 2, but illustrating a tool bit fully inserted in the bit holder assembly;

FIG. 4 is a longitudinal cross-sectional view similar to that of FIG. 3, but illustrating a fastener engaged with the tool bit and the retraction sleeve moved forward for magnetically engaging the fastener;

FIG. 5 is a longitudinal cross-sectional view similar to that of FIG. 2, but illustrating the retraction collar pulled rearward and the tool bit being removed from the bit holder assembly;

FIG. 6 is a perspective view of an alternative bit holder assembly according to the principles of the present disclosure;

FIG. 7 is a longitudinal or axial cross-sectional view of the bit holder assembly of FIG. 6;

FIG. 8 is a side view of a power tool with the bit holder assembly of the present disclosure mounted therein;

FIG. 9 is a side view of a power tool with the bit holder assembly integrally formed therein;

FIG. 10 is a perspective view of a bit holder assembly according to a third embodiment;

FIG. 11 is a cross-sectional view of the bit holder assembly of FIG. 10;

FIG. 12 is a partial cross-sectional view of a bit holder assembly according to an alternative embodiment;

FIG. 13 is a plan view of a hog ring type retainer utilized in the embodiment of FIG. 12;

FIG. 14 is a plan view of a rubber O-ring that can be utilized in the embodiment of FIG. 12;

FIG. 15 is a partial cross-sectional view of a bit holder according to a further embodiment according to the principles of present disclosure;

FIG. 16 is a perspective view of a ball and spring band which are utilized according to the alternative embodiment shown in FIG. 15;

FIG. 17 is a side plan view of a six-in-one rotary tool having a floating ring magnet according to the principles of the present disclosure;

FIG. 18 is a side plan view of the six-in-one rotary tool shown in FIG. 17 with the ring magnet in a forward position;

FIG. 19 is a cross-sectional view of the six-in-one rotary tool and floating ring magnet as shown in FIGS. 17 and 18;

FIG. 20 is a cross-sectional view of a pivotal bit holder accessory having a floating ring magnet mounted on a forward end thereof;

FIG. 21 is an alternative pivotal bit holder accessory having a ring magnet mounted to a floating locking sleeve of the accessory, according to the principles of the present disclosure;

FIG. 22 is a perspective view of a tool bit having a magnetic ring supported by a floating sleeve, according to the principles of the present disclosure;

FIG. 23 is a side plan view of the tool bit and floating sleeve shown in FIG. 22;

FIG. 24 is a cross-sectional view of the tool bit and floating sleeve shown in FIGS. 22 and 23;

FIG. 25 is a side plan view of the tool bit shown in FIG. 22;

FIG. 26 is a perspective view of the tool bit with a floating sleeve, according to the principles of the present disclosure;

FIG. 27 is a perspective view of the floating sleeve shown in FIG. 26;

FIG. 28 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 26;

FIG. 29 is a cross-sectional view similar to FIG. 28, with the floating sleeve in a forward position, according to the principles of the present disclosure;

FIG. 30 is a perspective view of an alternative floating sleeve design, according to the principles of the present disclosure;

FIG. 31 is a perspective view of a floating sleeve according to an alternative embodiment of the present disclosure;

FIG. 32 is a perspective view of a floating sleeve according to the present disclosure;

FIG. 33 is a perspective view of a tool bit having a floating sleeve, according to an alternative embodiment of the present disclosure;

FIG. 34 is a side plan view of the tool bit and floating sleeve shown in FIG. 33;

FIG. 35 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 33;

FIG. 36 is a side plan view of the floating sleeve shown in FIG. 33;

FIG. 37 is a perspective view of a tool bit and an alternative floating sleeve, according to the present disclosure;

FIG. 38 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 37;

FIG. 39 is a cross-sectional view of the floating sleeve shown in FIG. 37;

FIG. 40 is a perspective view of a tool bit and alternative floating sleeve design, according to the present disclosure;

FIG. 41 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 40;

FIG. 42 is a perspective view of the floating sleeve shown in FIG. 40;

FIG. 43 is a perspective view of a tool bit having a floating ring magnet supported by a floating sleeve, according to a further embodiment of the present disclosure;

FIG. 44 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 43;

FIG. 45 is a side plan view of the floating sleeve shown in FIG. 43;

FIG. 46 is a perspective view of a D-shaped ring utilized with the floating sleeve shown in FIG. 45;

FIG. 47 is a perspective view of a tool bit and alternative floating sleeve design according to the present disclosure;

FIG. 48 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 47;

FIG. 49 is a cross-sectional view taken along line 49-49 of FIG. 48;

FIG. 50 is a side plan view of the floating sleeve shown in FIG. 47;

FIG. 51 is a perspective view of a spring band utilized in the embodiment of FIG. 47;

FIG. 52 is a side plan view of a tool bit having a floating sleeve according to an alternative embodiment;

FIG. 53 is an exploded perspective view of the floating sleeve, ball, and spring band utilized in the embodiment of FIG. 52;

FIG. 54 is a perspective view of a tool bit and alternative floating sleeve design, according to the principles of the present disclosure;

FIG. 55 is a perspective view of the floating sleeve design as shown in FIG. 54 with the locking jaws in a disengaged position;

FIG. 56 is a perspective view of the floating sleeve design shown in FIG. 54 with the lock collar shown in the locked position for engaging the floating sleeve to the tool bit;

FIG. 57 is a partial cutaway perspective view of an alternative floating sleeve design according to the present disclosure;

FIG. 58 is a side plan view of a pair of ring magnets disposed around a tool bit with a connecting sleeve removed for illustrative purposes, according to the principles of the present disclosure;

FIG. 59 illustrates a sleeve that is mounted to the pair of ring magnets as shown in FIG. 58;

FIG. 60 is a side plan view of an alternative bit holder assembly according to the principles of the present disclosure;

FIG. 61 is a longitudinal or axial cross-sectional view of the bit holder assembly of FIG. 60;

FIG. 62 is a side plan view of the body portion of the bit holder assembly shown in FIG. 60;

FIG. 63 is a longitudinal or axial cross-sectional view of the floating sleeve of the bit holder assembly of FIG. 60;

FIG. 64 is a perspective view of a tool bit and alternative floating sleeve design according to the present disclosure;

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FIG. 65 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 64 with the floating sleeve in a forward position;

FIG. 66 is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 64 with the floating sleeve in a rearward position;

FIG. 67 is a perspective view of the floating sleeve shown in FIG. 64;

FIG. 68 is a side plan view of the floating sleeve shown in FIG. 64;

FIG. 69 is a longitudinal cross-sectional view of the floating sleeve shown in FIG. 64;

FIG. 70 is a side plan view of the tool bit shown in FIG. 64;

FIG. 71A is a cross-sectional view of a tool bit and floating sleeve according to a further embodiment of the present application with the floating sleeve shown in a forward direction;

FIG. 71B is a cross-sectional view of the tool bit and floating sleeve shown in FIG. 71A with the floating sleeve in a rearward position;

FIG. 72 is a perspective view of the floating sleeve shown in FIG. 71A;

FIG. 73 is a longitudinal cross-sectional view of the floating sleeve assembly shown in FIG. 71A;

FIG. 74 is a longitudinal cross-sectional view of the floating sleeve shown in FIG. 71A;

FIG. 75 is a side plan view of the floating sleeve shown in FIG. 71A;

FIG. 76 is a cross-sectional view of a tool bit and floating sleeve according to a further embodiment of the present application;

FIG. 77 is a cross-sectional view of the floating sleeve shown in FIG. 76 with an alternative tool bit;

FIG. 78 is a perspective view of floating sleeve assembly shown in FIG. 76;

FIG. 79 is a disassembled cross-sectional view of the floating sleeve shown in FIG. 76;

FIG. 80 is a cross-sectional view of the floating sleeve shown in FIG. 76 with the floating sleeve in a rearward position;

FIG. 81 is a cross-sectional view of the floating sleeve shown in FIG. 76 with the floating sleeve in a forward position;

FIG. 82 is a cross-sectional view of a tool bit and floating sleeve according to a further embodiment of the present application;

FIG. 83 is a side plan view of the tool bit shown in FIG. 82;

FIG. 84 is a cross-sectional view of a tool bit and floating sleeve according to a further embodiment of the present application; and

FIG. 85 is a side plan view of the tool bit shown in FIG. 84.

Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

Corresponding reference numerals indicate corresponding parts throughout the several views of the drawings.

Example embodiments will now be described more fully with reference to the accompanying drawings.

Example embodiments are provided so that this disclosure will be thorough, and will fully convey the scope to those who are skilled in the art. Numerous specific details are set forth such as examples of specific components, devices, and methods, to provide a thorough understanding of embodiments of the present disclosure. It will be apparent to those skilled in the art that specific details need not be employed, that example embodiments may be embodied in many different

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forms and that neither should be construed to limit the scope of the disclosure. In some example embodiments, well-known processes, well-known device structures, and well-known technologies are not described in detail.

The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms “a,” “an,” and “the” may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms “comprises,” “comprising,” “including,” and “having,” are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

When an element or layer is referred to as being “on,” “engaged to,” “connected to,” or “coupled to” another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being “directly on,” “directly engaged to,” “directly connected to,” or “directly coupled to” another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (e.g., “between” versus “directly between,” “adjacent” versus “directly adjacent,” etc.). As used herein, the term “and/or” includes any and all combinations of one or more of the associated listed items.

Although the terms first, second, third, etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as “first,” “second,” and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

Spatially relative terms, such as “inner,” “outer,” “beneath,” “below,” “lower,” “above,” “upper,” and the like, may be used herein for ease of description to describe one element or feature’s relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as “below” or “beneath” other elements or features would then be oriented “above” the other elements or features. Thus, the example term “below” can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

With reference to FIGS. 1-5, a first embodiment of the quick-change bit holder 10, according to the principles of the present disclosure, will now be described. The bit holder 10 includes a body 12 and retraction collar 14 slidably mounted on the body and retained in place by a sleeve bushing 32, as

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illustrated in FIG. 2. The body 12 can include a hex or polygonal-shaped shank 16 for mounting the bit holder 10 for rotation by a hand tool or a power tool.

With reference to FIG. 2, the body 12 also includes a hex or polygonal-shaped socket or bore 20 with the bore 20 opening axially outwardly toward the front or forward end of the bit holder 10. A plunger bore 22 extends axially from the hex-shaped socket or bore 20 toward the rear end of the bit holder assembly 10. Optionally, an ejection spring 24 can be disposed in the plunger bore 22. The body 12 includes an angular slot 26 formed transversely therein, with the slot 26 extending from the radially outer surface of the body 12 in an axially forward and radially inward direction to communicate with the interior of the hex bore or socket 20.

A coil spring 30 surrounds a portion of the body 12 and is disposed between the body 12 and the retraction collar 14. The coil spring 30 abuttingly engages a clip 44 which is received in a groove around a mid-portion of the body 12 and terminates in an integrally formed clip 34 that is disposed in the angular slot 26 and is designed to releasably engage a recess 38 in a hex or polygonal-shaped bit tip 40 as illustrated in FIG. 3. An internal annular sleeve 32 attaches to the rear portion of the retraction collar 14. The sleeve 32 can be secured to the collar 14 by adhesive, a press fit, thermal bonding, fasteners, pins, or other known attachment techniques. Received in a groove around a mid-portion of the body 12 is a clip 44 that acts as a stop against the sleeve 32 to limit forward travel of the retractable collar 14. The retractable collar 14 includes a forward shoulder portion 48 that, when pulled rearward, can engage the spring 30 and pull the clip portion 34 of the spring 30 pulling it rearward out of engagement with a bit 40 received in the hex-shaped cavity 20.

The retractable collar 14 is of a non-magnetic material with the exception of a magnetic tip 50 that can be in the form of a ring magnet. Alternative magnetic arrangements can be used including multiple non-ring shaped magnets combined to form a ring-like shape mounted at the tip of the collar 14. Both faces and the internal bore of the magnet, however, may remain accessible.

In operation, as shown in FIG. 2, the collar 14 starts in a neutral position with the collar biased forward and the spring clip 34 extending into the bore 20. Next, as shown in FIG. 3, a bit 40 is inserted into the bore 20 so that the spring clip 34 engages a notch 38 in the side of the bit 40 to prevent removal of the bit 40 from the bore 20. The bit 40 also compresses the ejection spring 24. The retraction collar 14 remains in the neutral position. Next, as shown in FIG. 4, when the bit 40 is used to drive a screw or fastener 54, the collar 14 floats as a result of the magnetic force radiating from the outer face to a forward position until the outer face of the magnet 50 reaches the fastener, enabling the outer face of the ring magnet 50 to magnetically adhere to the screw 54. This occurs before the bearing sleeve 32 engages the stop ring 44. The magnetic force, generating from the inner face of the magnet 50 by design, then draws the fastener 54 and the sleeve 14 jointly towards the body 12, the material of which it is made exhibiting magnet attractable properties resulting in holding the fastener 54 tight against the bit 40. The outer face of the magnet 50 also provides a stable surface to reduce movement of the fastener (wobble) during installation. The surface geometry of the face of the magnet 50 being such as to provide support to fasteners of multiple sizes, shapes, and configurations.

Next, as shown in FIG. 5, when the operation has finished and the user desires to remove the bit 40 from the bit holder 10, the user retracts the retraction collar 14 relative to the

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body 12, causing the spring 30 to compress, and the spring clip 34 to disengage from the bit 40, which allows the ejection spring 24 to attempt to eject the bit 40 from the holder 10. The ejection is, however, limited in movement to the point where the bit notch 38 is clear, and remains as such, of the clip 34 allowing for easy one handed removal, but not to the point where it leaves the bore 20. This controlled ejection is accomplished as a result of the magnetic field generating from the inner bore of the magnet 50 surrounding the bit 40.

With reference to FIGS. 6 and 7, an alternative quick change bit holder 60, according to the present disclosure, will now be described. The bit holder 60 includes a body 62 and a retraction collar assembly 64 mounted thereon. The body 62 includes a hex shank 66 and a hex-shaped socket or bore 70 formed in the body 62, with the bore 70 opening axially outwardly toward the front or forward end of the bit holder assembly 60. A plunger bore 72 extends axially from the hex-shaped socket or bore 70 toward the rear end of the bit holder assembly 60. Optionally, an ejection spring 74 can be disposed in the plunger bore 72. The body 62 includes an angular slot 76 similar to the slot 26 as described above. A coil spring 80 having an integral spring clip 84 surrounds the body 62 and is disposed between the body and the clip 84 such that the spring clip 84 is disposed in the angular slot 76 for engaging a bit tip 40 in the manner as discussed above with regard to the previous embodiment.

The retraction collar assembly 64 includes a rear collar 64a, an intermediate collar 64b and a forward collar 64c. A retainer clip 86 is disposed in a recessed groove in the outer surface of the body 62 and is disposed against a forward facing shoulder 88 of the rearward collar 64a. The intermediate collar 64b is press fit onto the rearward collar 64a to trap the retainer clip 86 therebetween. A rearward facing shoulder 90 is provided in a forward direction from the spring 80 on the intermediate collar 64b. The forward collar 64c is slidably supported on a forward end of the intermediate collar 64b and includes a magnetic tip 50 in the form of a magnet ring. The forward collar 64c acts as a floating sleeve and includes a rearward shoulder portion 92 that engages a forward shoulder portion 92 of the intermediate collar 64b to limit the forward travel of the forward collar 64c. The rear end of the forward collar 64c can be stretched over the forward end of the intermediate collar 64b to complete the collar assembly 64. Slots can be provided in the rear end of the forward collar 64c to facilitate assembly on the intermediate collar 64b. Alternatively, the collar could be retained through the usage of a spring ring mounted in a groove on the OD of the intermediate collar 64b and a mating taper and groove in the ID of the forward collar 64c.

In operation, a bit tip 40 can be inserted into the hex-shaped bore 70 of the bit holder body 62. The spring clip 84 engages a recess 38 in the bit tip 40 in order to retain the bit tip 40 within the bore 70. The forward collar 64c is able to float in a forward direction to engage a fastener that is engaged by the bit tip 40 in order to magnetically retain the fastener to the bit tip 40. When the fastener is inserted and the user wishes to remove the bit tip 40, the retraction collar 64 can be pulled in a rearward direction so that rearward facing shoulder 94 of intermediate collar 64c pulls rearward on the spring 80 to disengage the spring clip portion 84 from the recess 38 in the bit tip 40. The magnetic sleeve on this bit holder 60 works just like the other in that it grabs the screw and pulls it back towards the body 62 and against the bit while reducing wobble.

It should be understood that in each of the embodiments described herein, the bit holder 10, 60 can be mounted to a drill 2 as shown in FIG. 8 by inserting the hex-shaped shank

16, 66 into a chuck device. Alternatively, the bit holder of the present disclosure can be integrally constructed into the chuck device of the power tool 2, as shown in FIG. 9. Furthermore, although the present disclosure discloses a spring clip 34, 84 that is integral with the spring 30, 80, other arrangements of spring clips that are separate from the coil spring have also been utilized and can be utilized with the present disclosure. Examples of other arrangements include U.S. Pat. Nos. 7,086,813; 6,929,266; 6,261,035; and 5,988,957 which are incorporated herein by reference in their entirety. Furthermore, the use of a ball detent mechanism is also known in the art, and can be used in place of the integral spring clip and spring arrangement of the present disclosure. Further, other previous bit holder designs can be modified to include a ring magnet near the front of the outer actuation sleeve to allow the magnet and/or actuation sleeve to float forward to magnetize a fastener during operation.

With reference to FIGS. 10 and 11, a third embodiment of the quick-change bit holder 110, according to the principles of the present disclosure, will now be described. The bit holder 110 includes a body 112 and a retraction collar 114 slidably mounted on the body 112 and retained in place by a sleeve bushing 132, as illustrated in FIG. 11. The body 112 can include a hex or polygonal-shaped shank 116 for mounting the bit holder 110 for rotation by a hand tool or a power tool.

With reference to FIG. 11, the body 112 also includes a hex or polygonal-shaped socket or bore 120 with the bore 120 opening axially outwardly toward the front end of the bit holder 110. A plunger bore 122 extends axially from the hex-shaped socket or bore 120 toward the rear end of the bit holder assembly 110. Optionally, an ejection spring 124 can be disposed in the plunger bore 122. The body 112 includes an angular slot 126 formed transversely therein, with the slot 126 extending from the radially outward surface of the body 112 in and axially forward and radially inward direction to communicate with the interior of the hex bore or socket 120.

A coil spring 130 surrounds a portion of the body 112 and is disposed between the body 112 and the retraction collar 114. The coil spring 130 abuttingly engages a clip 144 which is received in a groove 145 around a mid-portion of the body 112 and terminates as an integrally formed clip 134 that is disposed in the angular slot 126 and is designed to releasably engage a recess 38 in a hex or polygonal-shaped bit tip 40 in the same manner as the embodiment illustrated in FIGS. 3 and 4. The internal annular sleeve 132 attaches to the rear portion of the retraction collar 114. Sleeve 132 can be secured to the collar 114 by adhesive, a press fit, thermal bonding, fasteners, pins, or other known attachment techniques. The clip 144 acts as a stop against the sleeve 132 to limit for travel of the retractable collar 114. Retractable collar 114 includes a forward shoulder portion 148 that when pulled rearward can engage the spring 130 and pull the clip portion 134 of the spring 130, pulling it rearward out of engagement with a bit 40 received in the hex-shaped cavity 120.

Retractable collar 114 supports a removable magnet ring 150 that is supported by a removable sleeve 152. Removable sleeve 152 is secured to the retractable collar 114 by a retainer such as an O-ring or bull nose ring 154 that is received in a groove in a forward portion thereof. The sleeve 152 is press fit over top of the retainer ring in order to releasably secure the sleeve 152 to the retraction collar 114.

The operation of the bit tip holder 110 as described is the same as the bit tip holder 10 as described above.

With reference to FIG. 12, a bit holder 160 is shown including a hex-shaped or polygonal-shaped shank 162 and a body portion 164 including a hex-shaped or polygonal-shaped bore

166 in an end thereof for receiving a bit 40. The outer surface of the body 164 is provided with an elongated annular recess 168. A floating sleeve 170 is provided on the end of the body 164 and supports a ring magnet 50 at an end thereof. The floating sleeve 170 includes an interior annular groove 172 that receives a retainer 174 therein. The floating sleeve 170 can be removably attached to the body 164 by force fitting the body 164 into a rear opening 176 of the floating sleeve 170 until the retainer 174 is received in the recess 168 of the body 164. The recess 168 is provided with a forward shoulder 178 and a rearward shoulder 180 that allow the floating sleeve 170 to travel in a forward and rearward direction as indicated by arrow A while the shoulders 178 and 180 limit the travel of the floating sleeve 170 by engagement with the retainer member 174. As shown in FIGS. 13 and 14, the retainer 174 can take the form of a steel hog ring, as shown in FIG. 13, or a rubber O-ring as shown in FIG. 14.

As an alternative, as illustrated in FIG. 15, the bit holder 160' can use an alternative retainer in the form of a ball 190 which can be received in an opening 192 in the floating sleeve 170' and can be retained therein by an annular spring band 194 that can be made of steel or plastic or other suitable material. In operation, the bit holder 160, 160' can be used to engage a fastener via the tool bit 40 and the floating sleeve 170, 170' allows the ring magnet 50 to move forward under its magnetic force to engage the fastener and magnetize the fastener to improve the retention of the fastener with the tool bit 40.

In a still further alternative embodiment of the bit holder, as shown in FIGS. 17-19, the bit holder 200 can be configured as a six-in-one rotary tool that includes a floating ring magnet 50. In particular, as illustrated in FIG. 19, the tool holder 200 includes a shank 202 that is integral with, and that extends rearwardly from a socket 204. Shank 202 is preferably hex-shaped or polygonal and includes a circumferential groove 206. The tool socket 204 includes a bore 208 that extends axially from the socket end and that is also preferably hex-shaped or polygonal. A reversible bit assembly 210 is received in the bore 208 and includes a sleeve 212 having a pair of axial storage cavities 216, 218 separated by a web 220. The sleeve 212 receives a first and a second bit driver 222, 224 therein. The outer surface of the sleeve 212, each of the cavities 216, 218, as well as a center section of the first and second bit drivers 222, 224 are each again preferably hex-shaped or polygonal such that each of the bit drivers 222, 224 rotate with the sleeve 212 and socket 204. Each of the first and second bit drivers 222, 224 are reversible within their respective cavities such that either of the bit ends 22a, 22b, 224a, 224b of the first and second bit drivers 222, 224 can extend from the sleeve 212. Additionally, sleeve 212 is reversible within the socket bore 208 such that either the first or second bit drivers 222, 224 operably extend from the socket 204. Accordingly, the tool may be configured such that any of the four bit driver ends 22a, 22b, 224a, 224b operably project from the socket 204. Either of the bit drivers 222, 224 may be removed from the sleeve 212 to expose the hex-shaped cavity 216, 218 for use as a nut driver. Finally, the tool's sixth driver is provided by removing the reversible bit assembly 210 from the socket bore to expose the hex-shaped bore 208 for use as a second nut driver. It is noted that the bore 208 is larger than the cavities 216, 218 thereby providing the ability to accommodate larger hex-shaped screw heads or nuts. In a preferred embodiment, the bore 208 is a $\frac{5}{16}$ inch hex-opening while the cavities 216, 218 are each $\frac{1}{4}$ inch hex openings.

Similar to the above embodiments, the outer surface of the socket 204 can be provided with an elongated annular recess 228 that can be engaged by a retainer 230 of a floating sleeve 232 that supports a ring magnet 50 at a forward end thereof.

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Accordingly, as the tool holder **200** is used to engage a fastener, one of the bit drivers **222**, **224** engage the fastener and the floating sleeve **232** allows the ring magnet **50** to move in a forward direction to engage the fastener to secure the fastener to the bit driver **222**, **224**. The floating sleeve **232** can be removed by applying a slight force in a forward direction to overcome the retaining force of the retainer **230** within the elongated annular recess **228**. Upon removal of the floating sleeve **232**, the reversible bit assembly **210** can be removed from the socket **204** so that the bit drivers **222**, **224** can be chosen for use.

With reference to FIG. **20**, a pivotal/rigid accessory **250** for power and hand tools is disclosed and includes a drive component **252** adapted to be connected to a power tool or hand tool and a driven component **254** that is pivotally connected to the drive component **252**. A locking sleeve **256** is provided for securing the driven component **254** for non-pivotal movement relative to the drive component **252**, or the locking sleeve **256** can be moved to a disengaged position that allows the driven component **254** to pivot relative to the drive component **252**. A pivot mechanism of this type is disclosed in U.S. Pat. No. 7,942,426, which is herein incorporated by reference. According to the principles of the present disclosure, a floating sleeve **260** can be provided at the forward end of the driven component **254** and supports a magnetic ring **50** at a forward end thereof to aid in retaining a fastener on a bit **40** received in a hex-shaped bore in the driven component **254**. As illustrated in FIG. **20**, the floating sleeve can include a retainer **262** that can be received in an elongated annular recess **264** on the outer surface of the driven component **254** to allow the floating sleeve **260** to move in a forward and rearward axial direction as indicated by arrow A.

As an alternative, as illustrated in FIG. **21**, the ring magnet **50** can be secured to the front end of the locking sleeve **256** which can be allowed to float in a forward direction to allow the ring magnet **50** to engage a fastener secured to the tool bit **40** received in a bore in the driven component **254** of the tool holder. FIG. **21** illustrates the pivoting arrangement between the driving component and the driven component which, again, is detailed in U.S. Pat. No. 7,942,426, which is herein incorporated by reference in its entirety.

With reference to FIGS. **22-25**, a tool bit **300** having a floating ring magnet **50**, according to the principles of the present disclosure, will now be described. The tool bit **300** includes a shaft having a hex-shaped shank **302** at a first end, and a working region **304** disposed at a second end. The shaft can have a section between the hex-shaped shank **302** and the working region **304** that has a reduced diameter region **306** that is disposed between two shoulders **308**, **310**. The reduced diameter region **306** provides a torsion zone that allows the shaft to twist to absorb forces while the tool bit **300** is being used to drive a fastener. A tool bit **300** having a torsion zone of this type is generally known in the art as disclosed by U.S. Pat. No. 5,704,261.

As illustrated in FIGS. **24** and **25**, the working region **304** of the tool bit **300** can be provided with various types of drive heads such as Phillips, flat, hex, square, and other known types of drive heads. A recessed groove **312** is provided in the working region **304** for receiving a retainer ring **314** therein. A ring magnet **50** is supported by a sleeve **316** that is retained on the tool bit **300** by the retainer ring **314** that is received within the recessed groove **312**. As the tool bit **300** is engaged with a fastener, the floating sleeve **316** is moved in a forward direction to allow the ring magnet **50** to engage the fastener to assist in retaining the fastener to the tool bit **300**. The floating sleeve **316** includes an interior shoulder **318** that engages the retainer **314** to limit the sleeve's forward axial travel. The tool

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bit **300** includes a shoulder **320** at an end of the working region **304** that limits the axial travel of the floating sleeve **316** in the opposite direction. The floating sleeve **316** can optionally be removed from the tool bit **300** by pulling on the floating sleeve **316** in an axial direction to overcome the retainer **314**. The retainer **314** can be a rubber O-ring or a steel hog ring that can be flexed inward when the floating sleeve **316** is either inserted onto or pulled off of the tool bit **300**.

With reference to FIGS. **26-29**, an alternative arrangement for mounting a ring magnet **50** to a tool bit **300** such as the tool bit as described above, will now be described. The ring magnet **50** is supported by a floating sleeve **330** that is slidably received on a forward end of the tool bit **300**. The floating sleeve **330** includes a plurality of axially extending fingers **332** that are integrally formed with the sleeve **330** and releasably engage the reduced diameter region of the tool bit between the two shoulders **308**, **310**. FIG. **28** illustrates the floating sleeve **330** in a rearward position, while FIG. **29** illustrates the floating sleeve **330** in a forward position for the ring magnet **50** to engage a fastener to help retain the fastener on the tool bit **300**. The floating sleeve **330** can be removed from the tool bit by pulling forward on the floating sleeve **330**, thus causing the fingers **332** to flex radially outward over top of the increased diameter portion at the head **304** of the tool bit **300**. It is noted that the floating sleeve **330** can be made from plastic, rubber, or other materials that allow flexibility of the fingers **332**. The ring magnet **50** can be secured to the floating sleeve **330** by adhesives, in-molding, or other known fastening techniques.

With reference to FIG. **30**, an alternative floating sleeve **340** design is shown for supporting a ring magnet **50** that can be received on a tool bit **300**. The sleeve **340** includes a first end **342** supporting the ring magnet **50** and a second end **344** including a single elongated slot **346** that allows the second end **344** of the sleeve **340** to flex outward for insertion of a tool bit **300** therein. The interior of second end **344** of the sleeve **340** includes a plurality of radially inwardly extending tabs **348** that are received in the reduced diameter portion **306** of the tool bit **300** and engage the forward and rearward shoulders **308**, **310** to limit axial movement of the sleeve **340** along the length of the tool bit **300**. The floating sleeve **340** can be made from plastic or rubber.

With reference to FIG. **31**, a floating sleeve **350**, according to an alternative embodiment, can include a plastic cup **352** that receives the ring magnet **50** at a forward end thereof and a rubber sleeve **354** at a rearward end thereof. The interior surface of the rubber sleeve **354** includes a plurality of radially inwardly extending tabs **356** at its rearward end, as illustrated in phantom in FIG. **31**. The radially inwardly extending tabs **356** are flexible to allow a tool bit **300** to be inserted into the sleeve **350** so that the tabs **356** engage the reduced diameter portion **306** between the forward and rearward shoulders **308**, **310** of the tool bit **300**. Thus, the sleeve **350** is allowed to float in a forward and rearward direction in the manner as described with regard to the above described embodiments.

With reference to FIG. **32**, an alternative floating sleeve **360** design is provided in which a floating ring magnet **50** is supported at a first end of a rubber sleeve **360**. The second end of the sleeve includes a plurality of radially inwardly extending tabs **362** that are flexible to allow a tool bit **300** to be inserted into the sleeve **360** wherein the tabs **362** are disposed in the reduced diameter portion **306** between the forward and rearward shoulders **308**, **310** of the tool bit **300**. The ring magnet **50** can be reinforced with a metal or plastic cap **364** disposed between the ring magnet **50** and the first end of the rubber sleeve **360**.

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With reference to FIGS. 33-36, an alternative floating sleeve 370 is provided for supporting a ring magnet 50 in a forward end 372 thereof. The floating sleeve 370 can be made from plastic and can include one or more flexible fingers 374 that engage the reduced diameter portion 306 of the tool bit 300 between the forward and rearward shoulders 308, 310 thereof. The fingers 374 can include a radially inwardly protruding end portion 376 that engages the reduced diameter portion 306 of the tool bit 300. The elongated fingers 374 are integrally formed with the plastic sleeve 370 to allow the fingers 374 to flex radially outward when a tool bit 300 is inserted therein or removed therefrom.

With reference to FIGS. 37-39, an alternative arrangement of a floating sleeve 380 is provided wherein the flexible fingers 382 are made from a spring steel and are separately attached to the floating sleeve 380 which can be made from plastic or metal. The flexible fingers 382 operate in the same manner as the fingers 374 disclosed in FIGS. 33-36 to retain the floating sleeve 380 onto a tool bit 300 while allowing the sleeve 380 to float in a forward and rearward direction until the fingers 382 engage the forward or rearward shoulders 308, 310 of the tool bit 300. The fingers 382 include radially inwardly protruding portions 384 that engage the reduced diameter portion 306 of the tool bit 300. The flexible fingers 382 can be secured to the sleeve 380 by a rivet 386 or can be in-molded into the sleeve 380. The sleeve 380 includes a pair of opposing windows 388 to receive the fingers 382.

With reference to FIGS. 40-42, an alternative floating sleeve 390 is provided for supporting a ring magnet 50 in a forward end thereof. The floating sleeve 390 can be made from plastic, rubber, or metal and can include a recessed annular groove 392 on an exterior surface thereof as well as a pair of oppositely disposed windows 394 that extend from the groove 392 into the interior of the sleeve 390. A rubber O-ring or a hog ring 396 can be provided in the annular groove 392 so as to extend into the window portion 394 of the annular sleeve 390 in such a manner that the O-ring or hog ring 396 can be received in the reduced diameter portion 306 of the tool bit 300 between the forward and rearward shoulders 308, 310 thereby retaining the floating sleeve 390 onto the tool bit 300. The reduced diameter portion 306 of the tool bit allows the floating sleeve 390 to move in a forward and rearward direction to allow the ring magnet 50 to engage a fastener for securing the fastener to the tool bit 300.

With reference to FIGS. 43-46, a still further alternative embodiment of the floating sleeve 400 is shown wherein the floating sleeve 400 supports a ring magnet 50 at a forward end and includes an exterior annular groove 402 with an opening 404 on one side that communicates to the interior of the sleeve 400. The annular groove 402 receives a D-shaped ring 406 having a generally flat portion 408 along one side thereof that is received in the window opening 404 of the annular groove 402 so that it communicates to the interior of the sleeve 400. The flat portion 408 of the D-shaped ring 406, as shown in FIG. 46, is received in the reduced diameter portion 306 of the tool bit 300 between the forward and rearward shoulders 308, 310 to limit the axial movement of the floating sleeve 400 in the forward and rearward directions.

With reference to FIGS. 47-51, an alternative arrangement of the floating sleeve 410, according to the principles of present disclosure, will now be described. The floating sleeve 410 includes an elongated annular recess 412 on an outer surface thereof and a plurality of window openings 414 extending therethrough within the elongated annular recess 412. The openings 414 each receive a ball 416 therein and a spring band 418 is received within the elongated annular recess 412 over top of the balls 416 to secure the balls 416

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within the openings 414. The balls 416 are designed to be received in the reduced diameter portion 306 of the tool bit 300 between the forward and rearward shoulders 308, 310 to limit the axial movement of the floating sleeve 410 in the forward and rearward directions. During insertion of the tool bit 300 into the floating sleeve 410, the spring band 418 allows the balls 416 to be pushed radially outward against the spring force of the band 418 while the head of the tool bit 300 is inserted into, or removed from, the sleeve 410. As the balls 416 reach the reduced diameter portion 306, the balls 416 move radially inward reducing the force of the spring band 418 on the balls 416. It is intended that the balls 416 provide an interference when engaging the forward and rearward shoulders 308, 310 of the reduced diameter portion 306, but do not provide significant resistance to the floating motion of the sleeve 410 along the tool bit 300.

With reference to FIGS. 52 and 53, an alternative floating sleeve 420 is shown utilizing a single ball 422 wherein the spring band 424 is provided with an opening 426 therein for maintaining the position of the spring band 424 relative to the ball 422 that is received in the single opening 426 of the floating sleeve 420.

With reference to FIGS. 54-56, an alternative floating sleeve 430, according to the principles of present disclosure, will now be described. The floating sleeve 430 supports a ring magnet 50 at a forward end thereof and includes a pair of lock jaws 432 that are pivotally mounted to the floating sleeve by pivots 434. The lock jaws 432 each include radially inwardly extending tabs 436 that are designed to be engaged within the reduced diameter portion 306 of the tool bit 300. The lock jaws 432 can be pivoted to an engaged position, as illustrated in FIG. 54, and a lock collar 438 can be pulled over top of the lock jaws 432, as illustrated in FIG. 56, to secure the lock jaws 432 to the tool bit 300. The ring magnet 50 is supported at the forward end of the floating sleeve 430 and the lock jaws 432 limit the axial movement of the floating sleeve 430 along the tool bit 300 to allow the ring magnet 50 to float to an engaged position when the tool bit 300 is engaged with a fastener. In order to remove the sliding sleeve 430 from the tool bit 300, the lock collar 438 can be pulled in a forward position allowing the lock jaws 432 to be pivoted radially outward so that the tool bit 300 can be removed from the floating sleeve 430. It is noted that the lock collar 438 can be made of a flexible material, or can have a rigid outer ring with a flexible material on the interior thereof that allows the lock collar 438 to be retained on the lock jaws 432 when they are in the locked position.

With reference to FIG. 57, an alternative floating sleeve 440 is shown including a ring magnet 50 at a forward end of a plastic sleeve. The plastic sleeve 440 has a slot 442 therein and has exterior cam surfaces 444 thereon. A rotating sleeve 446 is engaged with the cam surfaces 444 of the sleeve 440 and the rotating sleeve 446 can be rotated to cause plastic sleeve 440 to be retained in a radially inward direction to positively engage the radially inwardly extending tabs 448 of the sleeve 440 within the reduced diameter portion 306 of the tool bit 300 between the forward and rearward shoulders 308, 310 thereof. The rotating sleeve 446 can also be rotated to an unlocking position that allows the sleeve 440 to flex outwardly sufficiently enough to allow removal of the bit 300 from the floating sleeve 440.

With reference to FIGS. 58 and 59, a further embodiment of the present disclosure will now be described. With this embodiment, the use of a tool bit 450 having a hex-shaped shaft 452 without a reduced diameter portion is provided. A floating sleeve 454 is provided with two interior ring magnets 456, 458 (as illustrated in FIG. 58 with the sleeve 454

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removed) which are positioned with both poles opposing one another at approximately 10 mm apart. With both poles of the ring magnets **456**, **458** opposing one another, the sleeve **454** will move freely along a length of the tool bit **452** as they are captured by the non-magnetic sleeve **454**. An O-ring **460** can optionally be placed between the two magnets **456**, **458** to provide resistance to movement of the floating sleeve **454** if so desired. The opposing poles of the magnets **456**, **458** cause the sleeve **454** to float on the bit **450** until a face of the forward magnet **458** contacts a head of a fastener that has been placed on the driving end **462** of the tool bit **450**. Once that contact is made, the sleeve **454** then positions itself such that the fastener remains in place on the bit **450** during installation. Once the faster is securely started, the sleeve **454** can be drawn back onto the bit **450** if desired where it will remain during the driving and seating of the fastener.

With reference to FIGS. **60-63**, a bit holder assembly **470** is disclosed including a body **472** and a floating sleeve **474**. The body **472** includes a first end defining a shank **476** and a second end defining a polygonal cavity **478** that can be hex-shaped or can have another polygonal shape. At the inner end of the polygonal cavity **478**, an additional bore **480** can be provided for receiving a magnet **482** therein. An exterior surface of the body **472** at the second end includes a threaded portion **484** which is adapted to receive a threaded cap **486**. The threaded cap **486** includes interior threads **488** that engage the threaded portion **484**. The threaded cap **486** also includes a radially inwardly extending shoulder **490** that captures an O-ring **492** axially between the shoulder **490** and an end surface **494** of the body **472**. At a rear end of the threaded portion **484**, an annular groove **496** is formed having a forward shoulder **498**. At the rearward end of the threaded cap **486**, a shoulder **500** is formed for engagement with the shoulder **498** at the forward end of the annular groove **496**. The shoulders **498**, **500** limit the axial movement of the threaded cap **486** in the forward axial direction.

When a bit **40** (not shown) is inserted into the polygonal cavity **478**, the threaded cap **486** can be tightened against the O-ring **492** causing the O-ring **492** to expand radially inwardly to engage the bit **40** and secure the bit **40** within the cavity **478**. In order to remove the bit **40**, the threaded cap **486** can be rotated to release the clamping force against the O-ring **492** thereby allowing the O-ring **492** to disengage the bit **40** and allow the bit **40** to be removed.

The body **472** also includes an annular groove **502** located at an intermediate location along the body **472**. The annular groove **502** is disposed in the exterior surface of the body and is elongated in the axial direction so as to receive a C-shaped hog ring **504** that is received in an annular recess **506** on the interior of the floating sleeve **474**. The C-shaped hog ring **504** can travel axially along the length of the annular groove **502** to allow the floating sleeve **474** to float in a forward and rearward direction. The annular groove **502** has forward and rearward shoulders that limit the axial movement of the floating sleeve. The C-shaped hog ring **504** is flexible to allow removal of the floating sleeve **474** from the body **472** in order to gain access to the threaded cap **486** for tightening and loosening the cap **486** to allow insertion and removal of bits **40** from the polygonal cavity **478**. A forward end of the floating sleeve **474** supports a ring magnet **50** that is allowed to move in forward and rearward directions to engage and magnetize a fastener to retain the fastener to the tool bit **40**. A spacer sleeve **508** can be disposed rearward of the ring magnet **50** and can limit the rearward movement of the floating sleeve **474** by engagement with a forward end of the threaded cap **486**.

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In operation, the shank **476** can be inserted into a drill either directly or indirectly via a quick release chuck device. The floating sleeve **474** can be removed from the body **472** and a bit **40** can be inserted into the polygonal cavity **478**. The magnet **482** would attract the tool bit **40** to the rearward-most location within the polygonal cavity **478**. The threaded cap **486** can then be tightened in the rearward direction **R** to cause the O-ring **492** to expand radially inward while being compressed and thereby engage the bit **40** and secure the bit **40** in the polygonal cavity **478**. The floating sleeve **474** can then be slid over the end of the body **472** so that the C-shaped hog ring **504** is received within the annular groove **502** to limit the axial movement of the floating sleeve **474**. When a fastener **54** (not shown) is brought into engagement with the tool bit **40**, the floating sleeve **474** under the influence of the ring magnet **50** can slide axially forward to engage the fastener **54** to thereby magnetize the fastener **54** and retain it to the bit **40**.

With reference to FIGS. **64-70**, an alternative arrangement of the floating sleeve **510**, according to the principles of the present disclosure, will now be described. The floating sleeve **510** includes an elongated annular recess **512** on an outer surface thereof and a pair of tapered window openings **514** extending through the sleeve **510** opposite one another within the elongated annular recess **512**. The window openings **514** each receive a ball **516** therein and a spring band **518** is received within the elongated annular recess **512** over top of the balls **516** to secure the balls **516** within the tapered window openings **514**. The balls **516** are designed to be received in a reduced diameter portion **306** of the tool bit **300** between the forward and rearward shoulders **308**, **310** to limit the axial movement of the floating sleeve **510** in the forward and rearward directions. During insertion of the tool bit **300** into the floating sleeve **510**, the spring band **518** allows the balls **514** to be pushed radially outward against the spring force of the band **518** while the working region **304** of the tool bit **300** is inserted into, or removed from, the sleeve **510**. As the balls **516** reach the reduced diameter portion **306** of the tool bit **300**, the balls **516** move radially inwardly reducing the force of the spring band **518** on the balls **514**. It is intended that the balls **514** provide an interference when engaging the forward and rearward shoulders **308**, **310** of the reduced diameter portion **306**, but do not provide significant resistance to the floating motion of the sleeve **510** along the tool bit **300**. A ring magnet **50** is disposed at the forward end of the floating sleeve **510** and is designed to magnetize a fastener **54** (not shown) that is engaged to the bit **300**. FIG. **65** shows the floating sleeve **510** in a forward position while FIG. **66** shows the floating sleeve **510** in a rearward position.

FIGS. **71-75** illustrate an alternative arrangement of the floating sleeve **530** which is arranged with the same construction as the floating sleeve **510** with different external dimensions and appearance. Accordingly, the same reference numerals used for describing the components of the floating sleeve **510** are used for the components of the floating sleeve **530** and a detailed description of the floating sleeve **530** is not believed to be necessary, other than to note that its dimensions are different from that of the ring magnet assembly **510** in order to be used with a different type of bit having a smaller working head region and/or longer reduced diameter portion.

With reference to FIGS. **76-81**, an alternative tool bit assembly **550** will now be described. The tool bit assembly **550** includes a tool bit **552**, a base collar **554** that is received on the tool bit **552**, and a floating sleeve **556** that is slidably received on the base collar **554**. A front end of the sleeve **556** is tapered inwardly. This intuitively prevents the user from attaching the sleeve backwards on the bit.

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As shown in FIG. 76, the tool bit 552 can be of the type that includes a shank portion 558 and a working end 560 with a reduced diameter portion 561 and an annular groove 562 disposed in an intermediate location thereon. As an alternative, the tool bit 552', as shown in FIG. 77, can include recessed grooves at the corner edges of the hex-shaped shank 558 instead of the annular groove 562.

The base collar 554 includes an internal recessed groove 568 that receives a retainer ring 570 therein. The retainer ring 570 is designed to be received in the annular groove 562 of the tool bit 552 or within the recessed grooves 564 of the alternative bit 552'. Retainer ring 570 secures the base collar to the tool bit 552, 552'. The base collar 554 includes a reduced diameter portion 572 having a recessed groove 574 in an outer surface thereof. A stop shoulder 576 is disposed at a rearward end of the reduced diameter portion 572. The floating sleeve 556 is movably received on the reduced diameter portion 572. The floating sleeve 556 includes an internal annular groove 578 that receives a retaining ring 580 received in the recessed groove 574. Retaining ring 580 limits the axial movement of the floating sleeve 556 via the forward and rearward shoulders 582, 584 of the annular groove 578. The rearward end 586 of the floating sleeve 556 engages the stop shoulder 576 of the base collar 554. A ring magnet 50 is received in a forward end of the floating sleeve 556 and is designed to magnetize a fastener to retain the fastener to the working head region 560 of the tool bit 552.

With reference to FIGS. 82-85, the base collar 554' of the tool bit assembly 550 of FIGS. 76-81 has been modified to include an internal shoulder portion 590 that engages a forward shoulder 592 of the reduced diameter portion 561 of the tool bit 552. The shoulder portion 590 and the retainer ring 570 secure the base collar 554' relative to the tool bit 552 so that the movement of the floating sleeve 556 can be better controlled. FIGS. 82 and 84 show the modified base collar 554' engaged with alternative tool bits 552, 552'.

The foregoing description of the embodiments has been provided for purposes of illustration and description. It is not intended to be exhaustive or to limit the disclosure. Individual elements or features of a particular embodiment are generally not limited to that particular embodiment, but, where applicable, are interchangeable and can be used in a selected embodiment, even if not specifically shown or described. The same may also be varied in many ways. Such variations are not to be regarded as a departure from the disclosure, and all such modifications are intended to be included within the scope of the disclosure.

What is claimed is:

1. A bit holder assembly for a rotary tool, comprising:
 - a body having a shank at its rearward end and a coaxial socket formed at a second end to allow a tool bit to be inserted therein, an exterior surface of said body including a threaded portion at said second end;
 - a threaded cap having internal threads engaging said threaded portion of said body and securing an O-ring at an open end of said coaxial socket;
 - a floating collar slidably disposed on said body and including a ring magnet disposed at a forward end of the floating collar to magnetize a fastener to retain the fastener to the tool bit.
2. The bit holder assembly according to claim 1, wherein the ring magnet is attached directly to said floating collar.
3. The bit holder assembly according to claim 1, wherein said threaded cap is tightened against said O-ring to cause said O-ring to expand radially inward to engage and retain a bit within said coaxial socket.

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4. The bit holder assembly according to claim 1, wherein said floating collar includes an internal groove on an inner surface thereof and said floating collar is retained on said body by a C-shaped ring received in said internal groove and a first annular groove in the exterior surface of said body.

5. The bit holder assembly according to claim 4, wherein one of said internal groove and said first annular groove is elongated in an axial direction to allow the C-shaped ring to move along an axial length of said one of said internal groove and said first annular groove.

6. The bit holder assembly according to claim 1, wherein said floating collar supports a spacer ring between said ring magnet and said threaded cap.

7. The bit holder assembly according to claim 1, wherein said body includes a second annular groove in said exterior surface adjacent to said threaded portion, wherein said threaded cap has an internal shoulder that engages a forward shoulder of said second annular groove to limit a forward axial movement of said threaded cap.

8. A tool bit assembly, comprising:

a shaft having a shank at a first end and a working region disposed at a second end, said shaft having a shaft section between said shank and said working region having a reduced diameter region disposed between two shoulders; and

a floating sleeve movably disposed at said second end of said shaft and having a pair of opposed window openings therein and a ball disposed in each of said pair of window openings and received in said reduced diameter region of said shaft and a ring magnet supported at a forward end of said floating sleeve to magnetize a fastener to retain the fastener to the working region of the tool bit.

9. The tool bit assembly according to claim 8, further comprising a spring clip surrounding said floating sleeve and retaining said pair of balls in said pair of window openings.

10. A tool bit assembly, comprising:

a tool bit including a shaft having a polygonal shank at a first end and a working head region disposed at a second end;

a base collar secured to said shaft by a retainer on an interior surface of the base collar that engages a recess in the shaft; and

a floating sleeve assembly slidably received on said base collar and including a ring magnet disposed at a forward end of said floating sleeve to magnetize a fastener to retain the fastener to the working head region of the tool bit.

11. The tool bit assembly according to claim 10, wherein said base collar includes an exterior surface with a first recessed groove, wherein an interior surface of said floating sleeve includes an axially extending second recessed groove that receives a retainer ring that is disposed in said first recessed groove.

12. The tool bit assembly according to claim 11, wherein said base collar includes a stop shoulder axially spaced from said first recessed groove, wherein a rear end of said floating sleeve engages said stop shoulder.

13. The tool bit assembly according to claim 10, wherein said retainer comprises a retainer ring and said an interior surface includes a recessed groove that receives the retainer ring, wherein said retainer ring engages the recess in said shaft to retain said base collar to said shaft.

14. The tool bit assembly according to claim 13, wherein the recess comprises an annular groove formed in the polygonal shank.

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15. The tool bit assembly according to claim **13**, wherein the recess comprises a plurality of recessed grooves at corner edges of the polygonal shank.

16. The tool bit assembly according to claim **10**, wherein said base collar includes an interior shoulder that engages a rearward shoulder of a reduced diameter region of said tool bit.

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